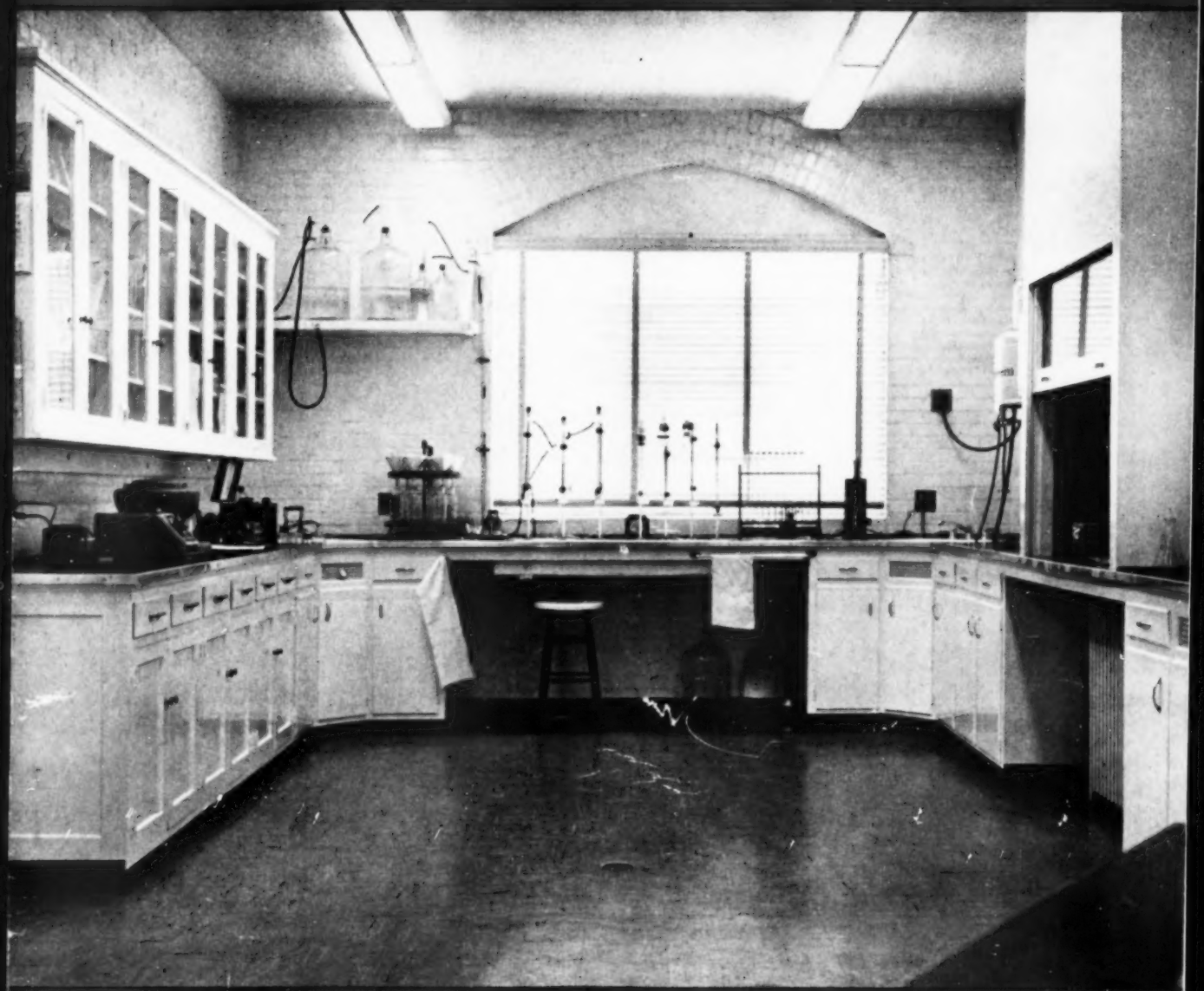
WATER & SEWAGE WORKS

WATER SUPPLY • INDUSTRIAL WASTE TREATMENT • SEWAGE DISPOSAL



JULY, 1953

Cedar Rapids, Iowa, Water Treatment Plant...

Portion of the well equipped chemical control laboratory.

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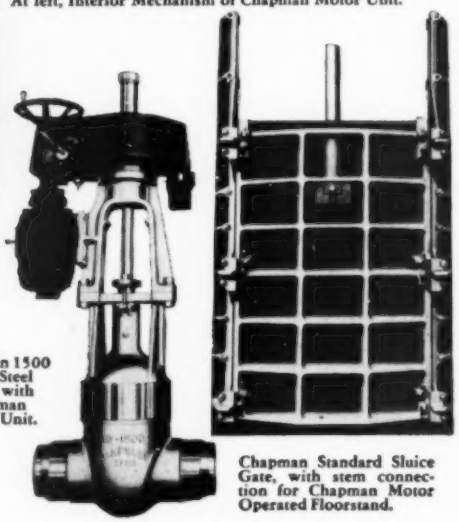
for Valves, Sluice Gates and Floorstands...

CHAPMAN'S *Motor Unit*

Above, Floorstand equipped with Chapman Motor Unit, Control Panel, Motor, Limit Switch and Push Button Station all completely wired. At left, Interior Mechanism of Chapman Motor Unit.

For positive control of large valves and sluice gates, the Chapman Motor Unit can safely be given your "power of attorney." The floorstands with Chapman Motor Units come to you with all wiring *complete*, so that all you have to do is bring the power leads into the connection box... which speeds up installation, insures proper operation, and saves wiring costs.

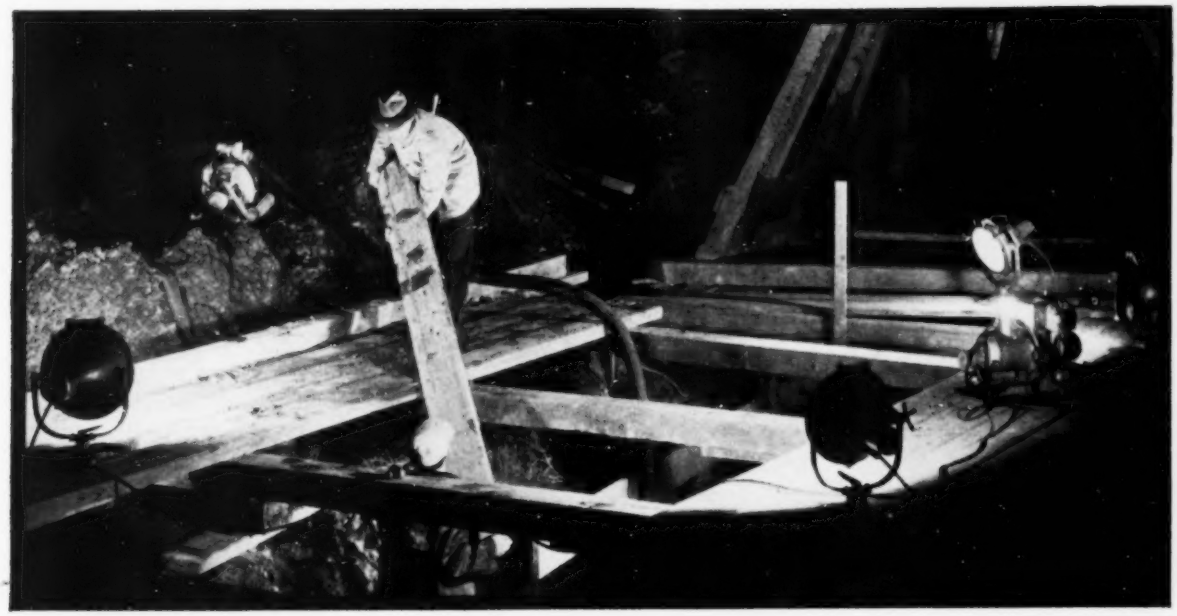
The Chapman Motor Unit is completely housed and thoroughly weatherproof. And the unit itself has the ruggedness of simplicity, with a slow-speed motor driving direct through two trains of spur gears. So there's no drift. The limit switch can be adjusted so the gate or valve closes to the exact seating position. Hand-operated, too, if the need arises. See what this modern electrically driven Motor Unit can do — *and save* — for you. Write for Catalog No. 50.

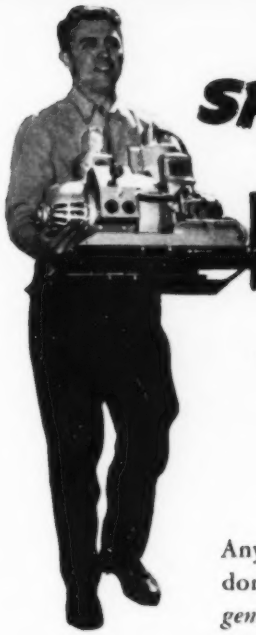


Chapman 1500 Series Steel Valve, with Chapman Motor Unit.

Chapman Standard Sluice Gate, with stem connection for Chapman Motor Operated Floorstand.

The CHAPMAN VALVE Mfg. Company
INDIAN ORCHARD, MASSACHUSETTS, U. S. A.





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Purification Works

YOUNGSTOWN, OHIO

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L. T. FAWCETT
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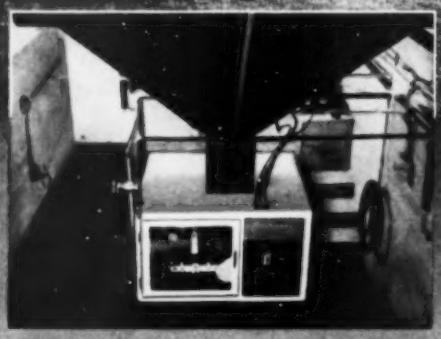
Mahoning Valley Sanitary District



One of the hardest battles ever fought to obtain a satisfactory water supply has been waged in the Mahoning Valley. To lick the problem of providing ample water year 'round for this major industrial area, the nation's fourth largest steel-producing center, has required engineering vision of the highest order. In addition to the present engineers, many others have made important contributions to the Mahoning Valley Sanitary District, including W. I. Van Arnum, former Chief Chemist, and M. L. Riehl, present Sup't. of Water Purification.

For many years Omega Chemical Feeders have served in the Mahoning Valley Purification Plant, feeding coagulant and softening chemicals for the treatment process. Recently the handling and feeding of activated carbon for taste and odor control underwent a major revision, to permit receiving and storing the chemical in carload shipments. Also fluoridation has been added to the treatment process. For both these new operations Omega Feeders were again selected: Omega Belt Gravimetric Feeders with Rotary Bin Gates for high-accuracy feeding of carbon from the storage bins . . . Omega Loss-in-Weight Gravimetric Fluoridizer for feeding fluorides. For Bulletins describing Omega Water Works Equipment, address Omega Machine Company (Division of B-I-F Industries), Providence 1, Rhode Island.

Omega Equipment furnished for the Mahoning Valley Sanitary District:

- 2—Belt Gravimetric Feeders with Rotary Bin Gates for feeding activated carbon.
- 1—Loss-in-Weight Gravimetric Fluoridizer.
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WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL
INDUSTRIAL WASTE TREATMENT

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One Solution to the Air Conditioning Peak Load Problem ..... *Pierce*
Can High Rate Filtration of Water be Justified? ..... *Cox*
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Rubber Hose Best and Most Economical Pump Packing ..... *Higgins*
Problems of the Small Water Works Operator ..... *Clark*
Sewage Works Practices (short-course type articles*) ..... *Bloodgood*

*In this issue is one of a series of the same type of articles on *Water Works Practices* by Dr. George E. Symons. Articles of the Symons and Bloodgood series are currently running in alternate issues.

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VOL. 100 **July, 1953** No. 7

Corrosion Control Experience in Cedar Rapids, Iowa 253
by Arnold K. Cherry, *Cedar Rapids, Iowa*

Hydraulics of Single Pipe Lines 257
by D. R. Taylor, *Baton Rouge, La.*

Water Works Practices 260
No. 4—The Hydrologic Cycle
by George E. Symons, *Larchmont, N.Y.*

1953 Conference of A.W.W.A. in Grand Rapids, Mich. 263

pH Measurement and Control in Water Treatment Plants 272
by Russell H. Babcock, *Foxboro, Mass.*

Dual Fuel Engines for Pumping Water Cut Power Costs 279
by J. A. Scanlan, *Austin, Tex.*

A Method for Trenching in Wet Unstable Soil 282
by AM Rawn, *Los Angeles, Calif.*

Safety in Sewage Works Maintenance and Operation (Part I) 284
by LeRoy W. Van Kleeck, *Hartford, Conn.*

Synthetic Ion Exchange Materials in Industrial Waste Treatment 288
by A. B. Mindler, *New York, N.Y.*

Design of Sewage Pumping Plants 291
by Raymond G. Martin, *Los Angeles, Calif.*

Editorial 294

Meetings Scheduled 78A

Manufacturers' and Equipment Items 92A

Literature and Catalog 110A

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30 YEARS GIVE PROOF *of Dependability!*

WRITES: *J. F. Bearden, Superintendent, Department of Water Supply, Walhalla, South Carolina.*

J. F. BEARDEN
SUPERINTENDENT

Town of Walhalla
Department of Water Supply
WALHALLA, S. C.

September 3, 1952

Mr. C. F. McAuley
Rockwell Manufacturing Company
1495 Northside Drive, N.W.
Atlanta 1, Georgia

Dear Mac:

On October 1, I bring to an end my 30 years of service as Superintendent of Water Supply for the Town of Walhalla. Though I will no longer take an active part, City Council has requested that I serve in an advisory capacity to the department.

I am taking this opportunity to express to you and the entire Rockwell organization my grateful thanks for the cooperation and service extended me.

I recall the day I placed my first order for Pittsburgh Meters with your Mr. Taylor. That was 30 years ago. When you have exclusively used a product for that long, you really appreciate the quality and dependability built into your meters and I have never once had reason to question my choice.

Mr. C. L. Walling, Assistant Superintendent since 1938, has been designated as my successor. I am glad to state that Mr. Walling will continue to use your meters because of their proven merit and performance.

In closing, may I again express my gratitude for the years of courteous service. To you and your entire organization my best wishes for continued success.

Sincerely,

J. F. Bearden

J. F. Bearden

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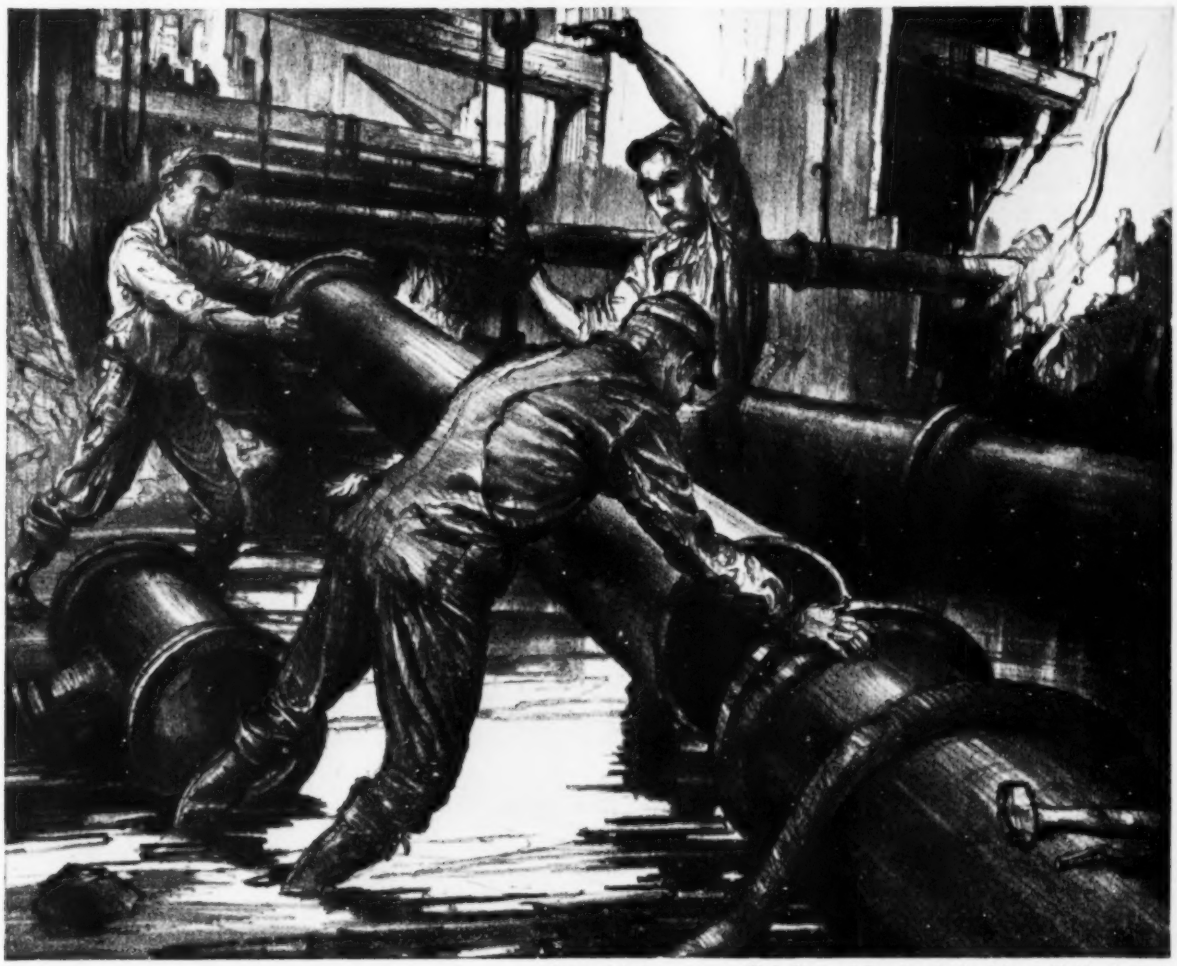

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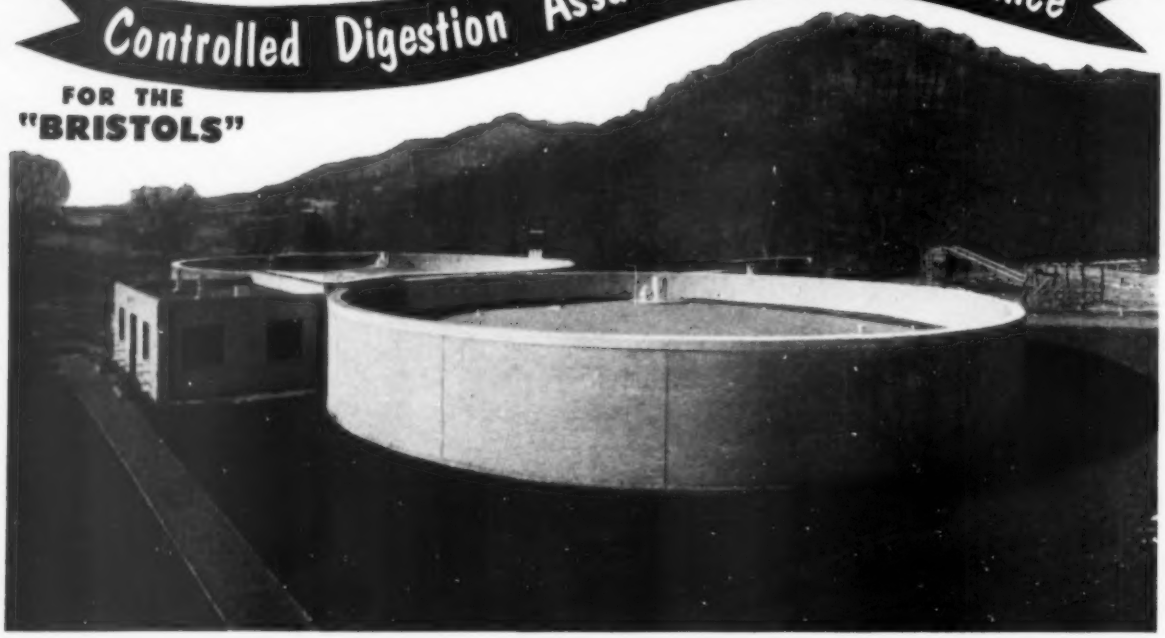

NESTLED in the Appalachians are the "twin" cities of Bristol, Tennessee and Bristol, Virginia. Both cities are jointly served by a single sewage-treatment plant, of the high-rate trickling filter type.

P.F.T. Controlled Digestion is a highlight of the plant. Two P.F.T. 90' Floating Cover Digesters ably handle digestion of sewage sludge. Each is equipped with a P.F.T. Supernatant Selector piped to a P.F.T. Supernatant Gauge, Sight Glass and Sampler within the control room to provide systematic withdrawal of supernatant liquor. Two P.F.T. No. 750 Digester Heater and Heat Exchangers, gas and oil fired, with accessory group "D" controls, maintain the sludge in the digester at optimum temperature and also provide automatic building heating. P.F.T. Gas Safety Equipment safeguards every phase of sludge gas storage, transmission and utilization.

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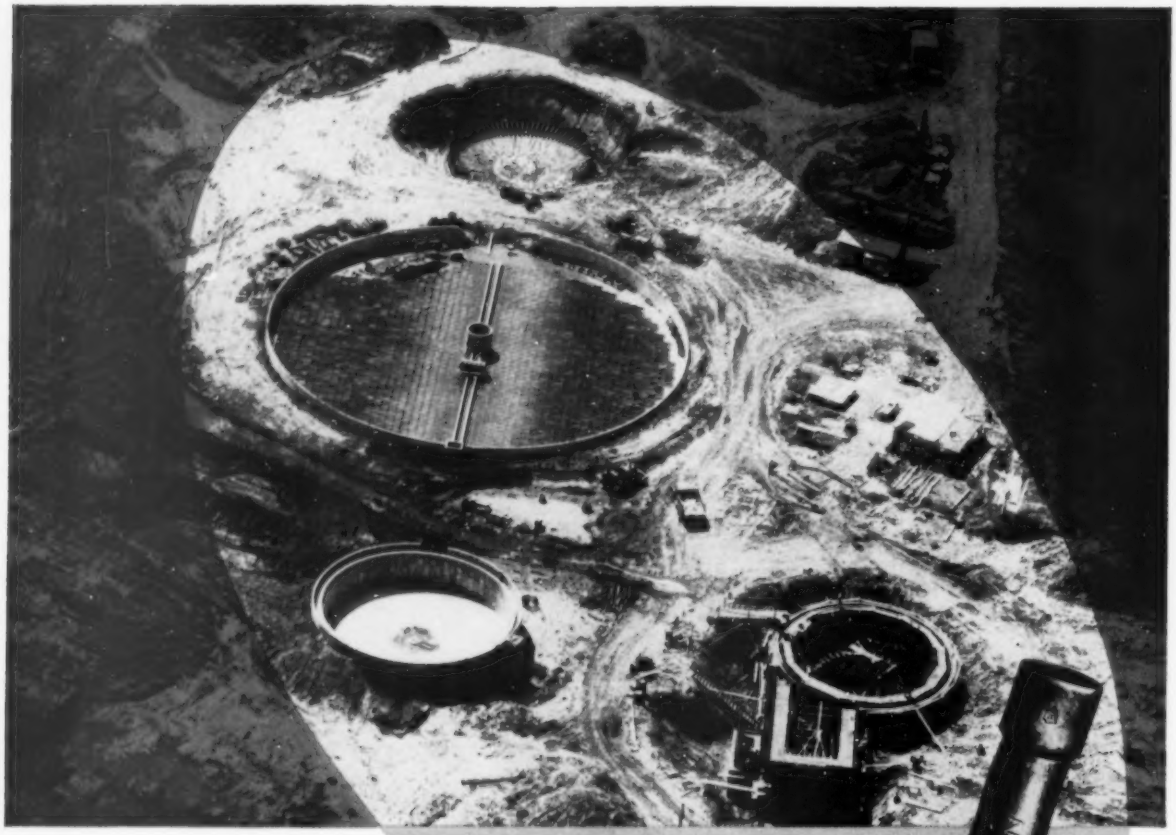

In this new Independence, Mo. sewage treatment plant,

Byers WROUGHT IRON PIPE safeguards the tough assignments

FILTER DISTRIBUTION ARMS
SLUDGE SAMPLING LINES
WATER SERVICE LINES
(2" OR SMALLER)
ALL GAS PIPING

This $1,000,000 sanitary sewerage project is completely modern in all respects—including its answer to the corrosion problem. In those services listed above, all of which face corrosive attack, Byers Wrought Iron pipe was used.

In the aerial view, taken during the early stages of construction, you see the two clarifiers, the trickling filter and the digester and control building at the right. The project also includes two pumping stations, 1½ miles of 8 and 12-inch force mains and 7½ miles of sewers ranging in size from 10 to 36 inches in diameter. Consulting engineer: Charles A. Haskins, Kansas City; contractor: Lippert Brothers, Inc., Oklahoma City, Okla.

Whether your sewage treatment plant is large or small, successful, economical operation depends heavily on the proper selection of material. Short-lived piping means early and costly repairs, and a heavy burden on the budget. Byers Wrought Iron pipe has demonstrated its exceptional qualities in practically every corrosive service, and provides a sound means of getting maximum life from the installation, with lower cost per year.

Our bulletin, WROUGHT IRON FOR SEWAGE TREATMENT AND DISPOSAL INSTALLATIONS, discusses the problems of corrosion encountered in numerous individual services. You'll find it helpful and informative. Write for a copy.

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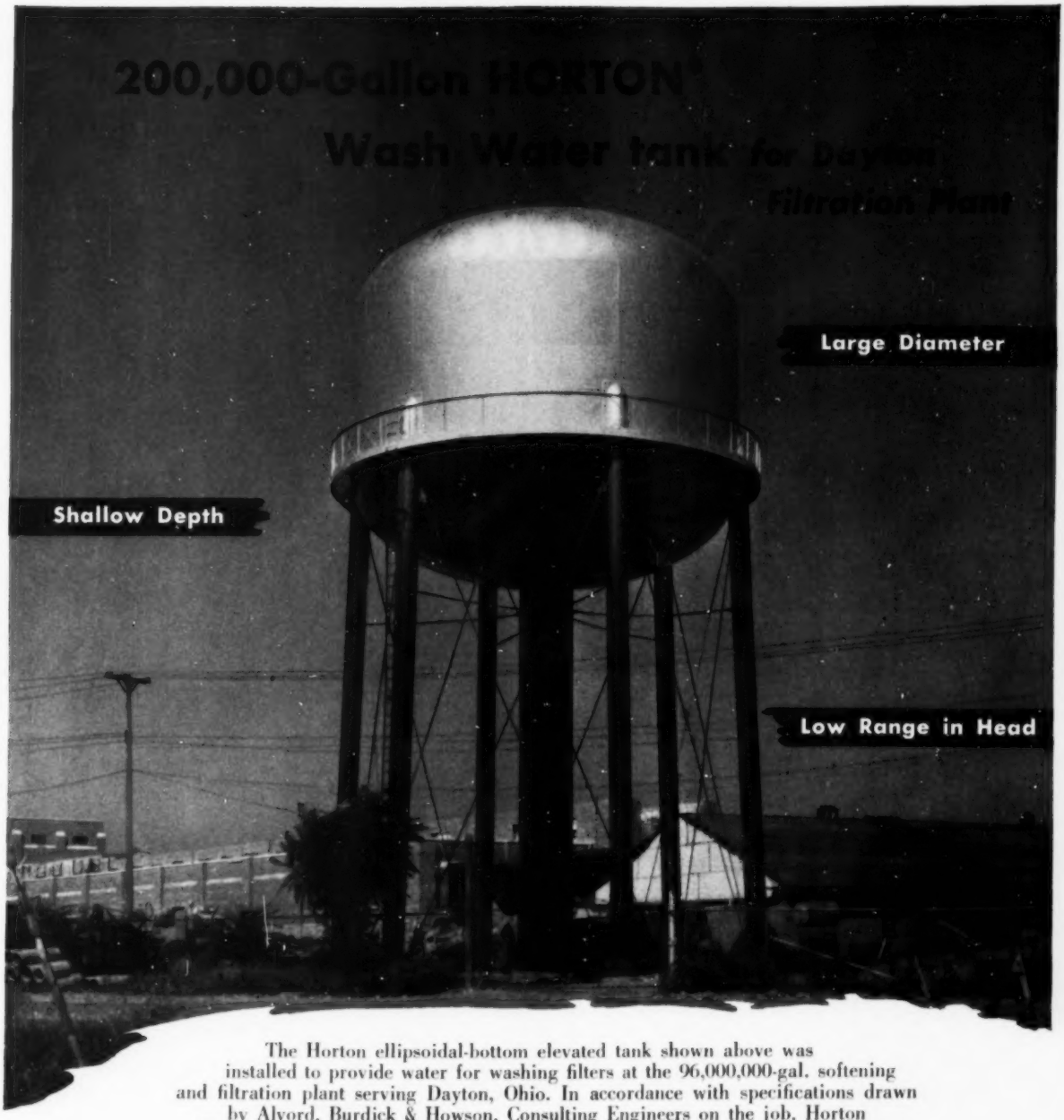

The Horton ellipsoidal-bottom elevated tank shown above was installed to provide water for washing filters at the 96,000,000-gal. softening and filtration plant serving Dayton, Ohio. In accordance with specifications drawn by Alvord, Burdick & Howson, Consulting Engineers on the job, Horton ellipsoidal-bottom tank design permits the storage of a large quantity of water with a low range in head—a necessary feature for filter washing service.

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Cleveland 15	2262 Midland Bldg.	San Francisco 4	1583-200 Bush St.
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"Century" pipe, 4" Class 150, ready for laying in trench in Oakland, Oklahoma.

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And as the years pass, "Century" pipe stays economical. It keeps on serving at full flow longer because it cannot rust, will not tuberculate, and actually grows stronger with age!

If you should like more information about this economical pipe, write for your free copy of "Mains Without Maintenance"—an authoritative booklet containing data of value to anyone interested in water main pipes. Write today!

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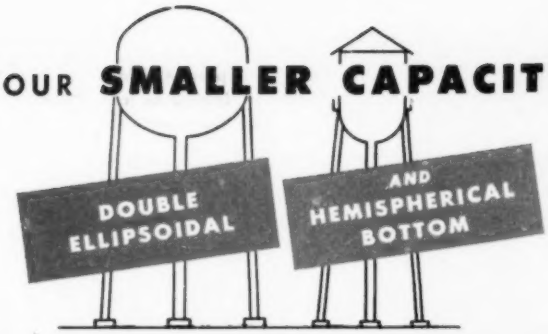

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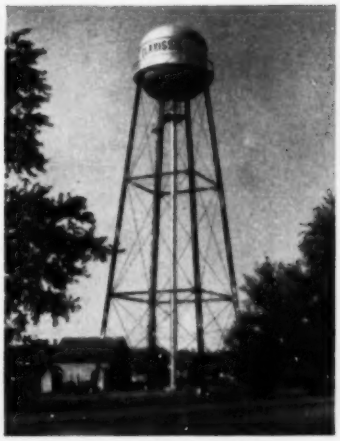

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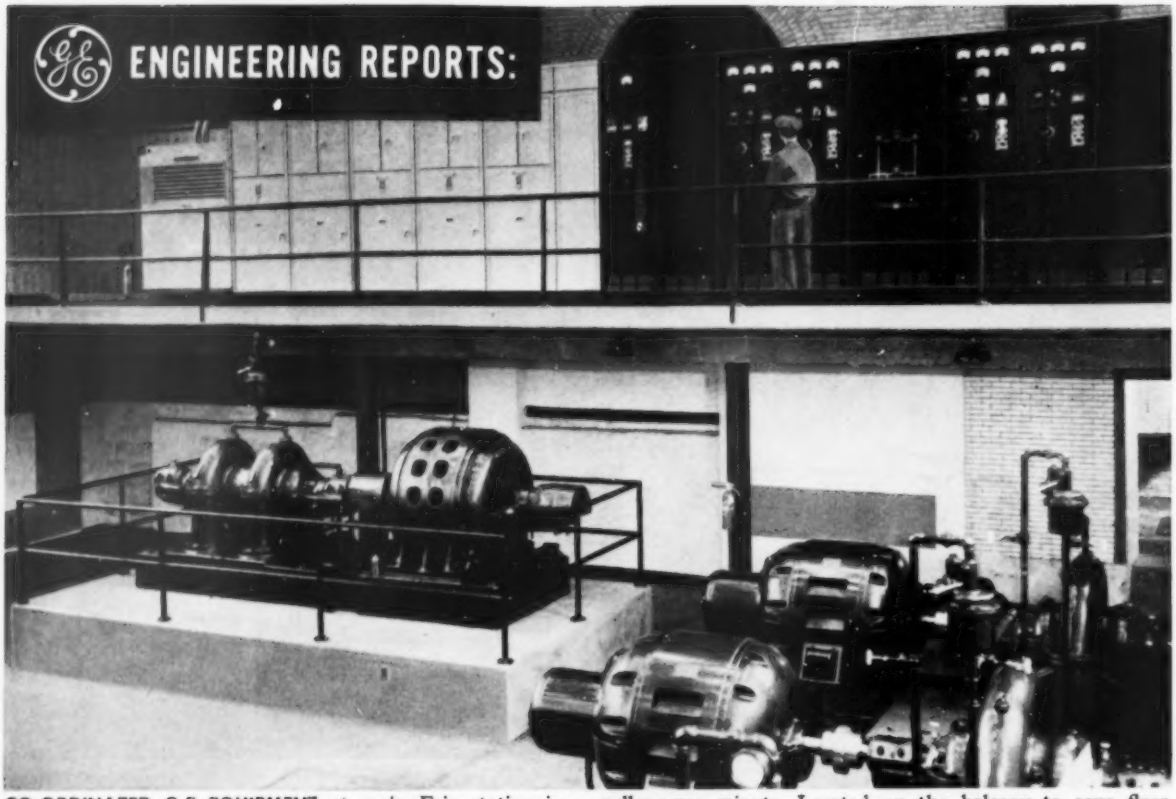
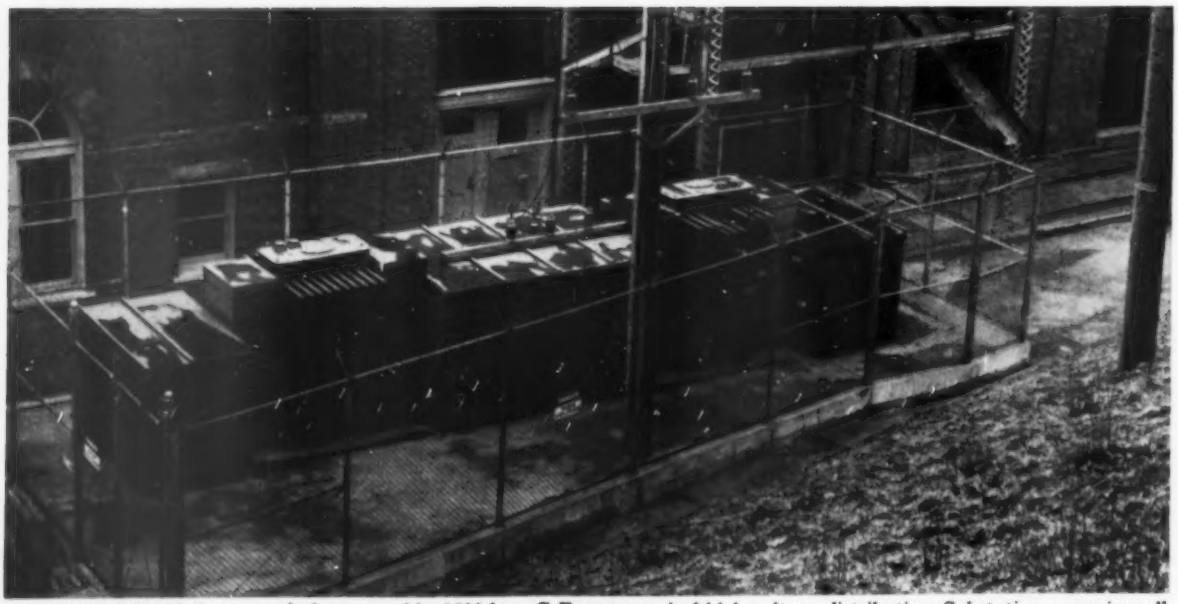


CO-ORDINATED G-E EQUIPMENT at main Erie station includes (bottom right) three 1000-hp 1200-rpm synchronous motors (two shown) driving DeLaval pumps rated 12,600 gallons per minute. Located on the balcony to save floor space are (r. to l.) metal-clad switchgear, Limitamp, compact load-center unit substations, and small-motor control center.

Erie looks ahead—triples main



INCOMING POWER is stepped down at this 1500-kva G-E master unit substation from 13,800 volts to 2400 volts for economical high-voltage distribution. Substation comprises all equipment needed between utility line and plant circuits.

PERSONNEL PROTECTION is provided by this G-E metal-clad switchgear assembly. Circuit-breakers—of adequate interrupting capacity—are easily removable to simplify maintenance.

CENTRAL OPERATING POINT for the plant is this G-E control desk, combining push buttons, indicating lights, and selector switches. Desk is conveniently located in pump room.

plant's water pumping capacity

Thorough system engineering cuts operating, fuel and maintenance costs—will pay for itself in 5 years

Acting now to meet future water-supply requirements, Erie, Pa., recently expanded its pumping facilities. General Electric application engineers—working closely with the city's engineering staff, Chester Engineers of Pittsburgh, consultants, and the Dravo Corporation's Machinery Division, contractors—co-ordinated the electric equipment for a modern, efficient system to replace old steam-driven units in the city's main plant.

Results: They tripled pumping capacity—from 20 to 60 mgd. They saved four-fifths the space formerly used. Five men can now operate the station instead of forty. In two years of 24-hour-per-day operation, no repair whatsoever has been needed, according to Supt. Maurice McMahan. And the cost of the installation will be completely repaid within five years by operating, fuel and maintenance savings.

This kind of G-E application engineering skill can help make your community's water-supply program pay off. For best results, call in your G-E Apparatus Sales representative early in the planning stage.

HOW YOU CAN ACT NOW FOR MORE WATER TOMORROW

Arouse public interest through showings of the new full-color movie, "Pipeline to the Clouds." It's part of G.E.'s *More Power to America* Water Supply Program. For more information, write on your letterhead for Bulletin GEA-5555 to General Electric Co., Section 666-77, Schenectady 5, N. Y.

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GENERAL ELECTRIC

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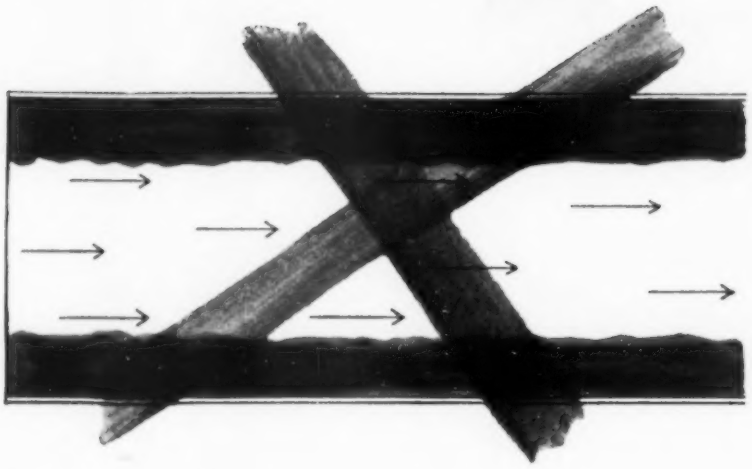
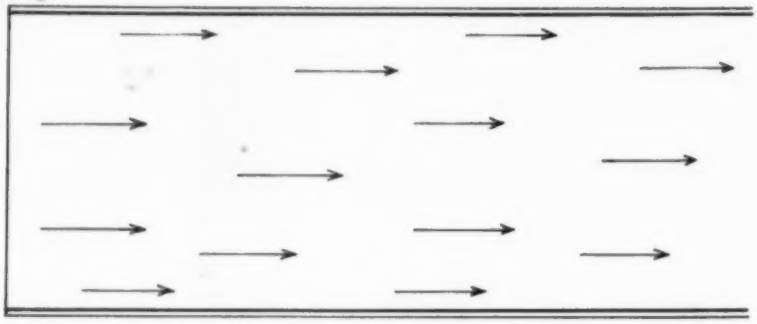
flow capacity stays high





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PIPE LINES don't "shrink" when they are lined with Bitumastic 70-B Enamel . . . because this durable enamel prevents rust, corrosion, incrustation and tuberculation. When your pipe line's coefficient of flow *stays* high, there's no need to spend money on *over-sized* pipe in order to allow for future loss in flow capacity.

Further, there's no need to specify a wall thickness any greater than that required to give the pipe adequate structural strength. Because Bitumastic 70-B Enamel—when applied to a thickness of $\frac{3}{32}$"—protects the exterior of pipe against the corrosive action of the soil in which it is buried. This makes it unnecessary to specify pipe with greater wall thickness in order to compensate for corrosion.

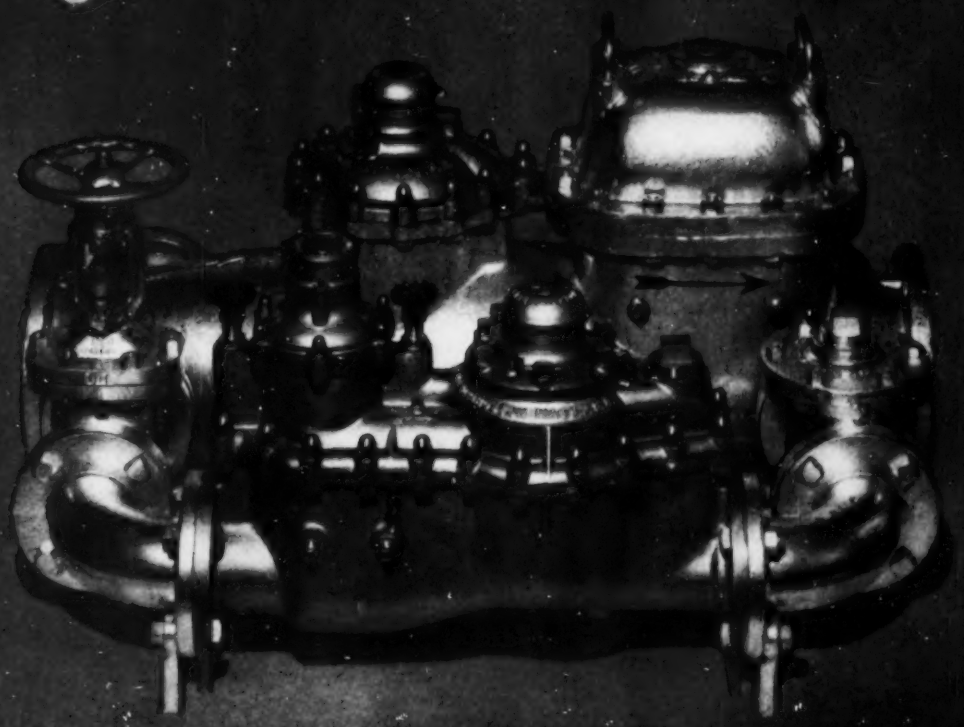
Summed up, Bitumastic 70-B Enamel saves money in two ways. For your large-diameter water lines, you can specify pipe with smaller inside diameter and with less wall thickness. Use strong, durable steel pipe, lined and coated with Bitumastic 70-B Enamel, and give your community these worth-while savings. Write for full information about hot-applied coatings.

KOPPERS BITUMASTIC® ENAMELS

KOPPERS COMPANY, INC., Tar Products Division, Dept. 761-T, Pittsburgh 19, Pa.

DISTRICT OFFICES: BOSTON, CHICAGO, LOS ANGELES, NEW YORK, PITTSBURGH, AND WOODWARD, ALA.

A Hersey Combination that has never been equaled



This Hersey Detector Meter, equipped with a bronze case Compound Meter on its by-pass is made only by the

HERSEY MANUFACTURING COMPANY

SOUTH BOSTON, MASS.

BRANCH OFFICES: NEW YORK PORTLAND, ORE. PHILADELPHIA ATLANTA DALLAS CHICAGO SAN FRANCISCO

You can cut installation costs ... lay pipe faster... speed completion of entire job...

—Because of this RING-TITE JOINT used with Transite Sewer Pipe

Long 13-foot lengths of Transite* Pipe are rapidly assembled with the Ring-Tite Coupling. With it, dollars-and-cents savings will be realized every step of the way during construction of the line.

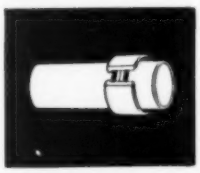
The 13-foot lengths reduce the number of joints and permit the pipe to be brought quickly and accurately to grade. Still more time is saved since each Ring-Tite joint can be checked as fast as it is assembled to reduce delays in backfilling and speed completion of the job.

LIGHT IN WEIGHT

Other time and money-saving advantages of Transite Sewer Pipe are found in its light weight and easy handling. These reduce trucking costs and pay off in simplified operation all along the line. And, too, the Ring-Tite joint eliminates the necessity for hot compounds and the time-consuming procedures that go with their use.

May we send you more facts about this asbestos-cement pipe and its Ring-Tite joint... and how they reduce infiltration to a minimum and cut other sewage costs as well? No obligation, of course. Please write for folder TR-103A. Address Johns-Manville, Box 60, New York 16, New York.

Why the RING-TITE JOINT cuts your sewage costs



Two rubber rings and Transite Sleeve (see cut-away view) can be assembled quickly over Transite Pipe ends to make a pressure-tight joint. These flexible joints effectively absorb vibration, help compensate for soil movements.

AND BUILDING SEWER PIPE, TOO! **Another J-M Asbestos-Cement Pipe, Transite Building Sewer Pipe, assures a tight sewer system throughout.** Many municipal officials are insisting that house and building connections to their sewage lines be made with Johns-Manville Building Sewer Pipe to assure tightness throughout their systems. This pipe also has the same type of rubber ring sealed joint that is shown above.

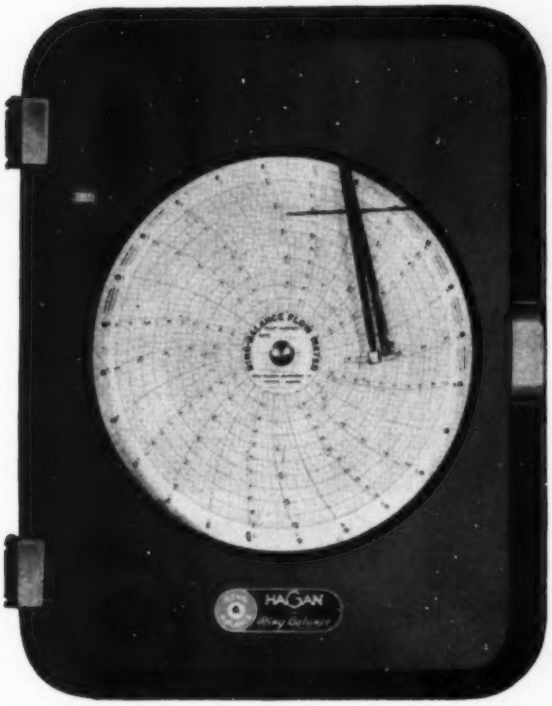
*Reg. U. S. Pat. Off.

JOHNS-MANVILLE PRODUCTS

Johns-Manville TRANSITE SEWER PIPE

For accurate, automatic compensation
for temperature—
for pressure—
for density—or for position

Install Hagan Compensated Ring Balance Meters



The Hagan Compensated Ring Balance Meter automatically adjusts pressure differential or flow readings to correct for variations in temperature, pressure, density or mechanical positioning.

For flow measurements, the built-in integrator totalizes the corrected flow automatically.

Any measurements, such as drum level, steam flow, or any of the variants such as temperature, pressure, or density may be indicated or recorded on the same chart with the corrected record.

Send coupon for Bulletin M-51.

HAGAN CORPORATION
HAGAN BUILDING, PITTSBURGH 30, PA.
Boiler Combustion Control Systems
Ring Balance Flow and Pressure Instruments
Metallurgical Furnace Control Systems
Control Systems for Aeronautical
and Automotive Testing Facilities

Hagan Corporation
Hagan Building • Pittsburgh 30, Pennsylvania

Please send me further information on Hagan Ring Balance Meters. I am particularly interested in _____

_____

NAME _____

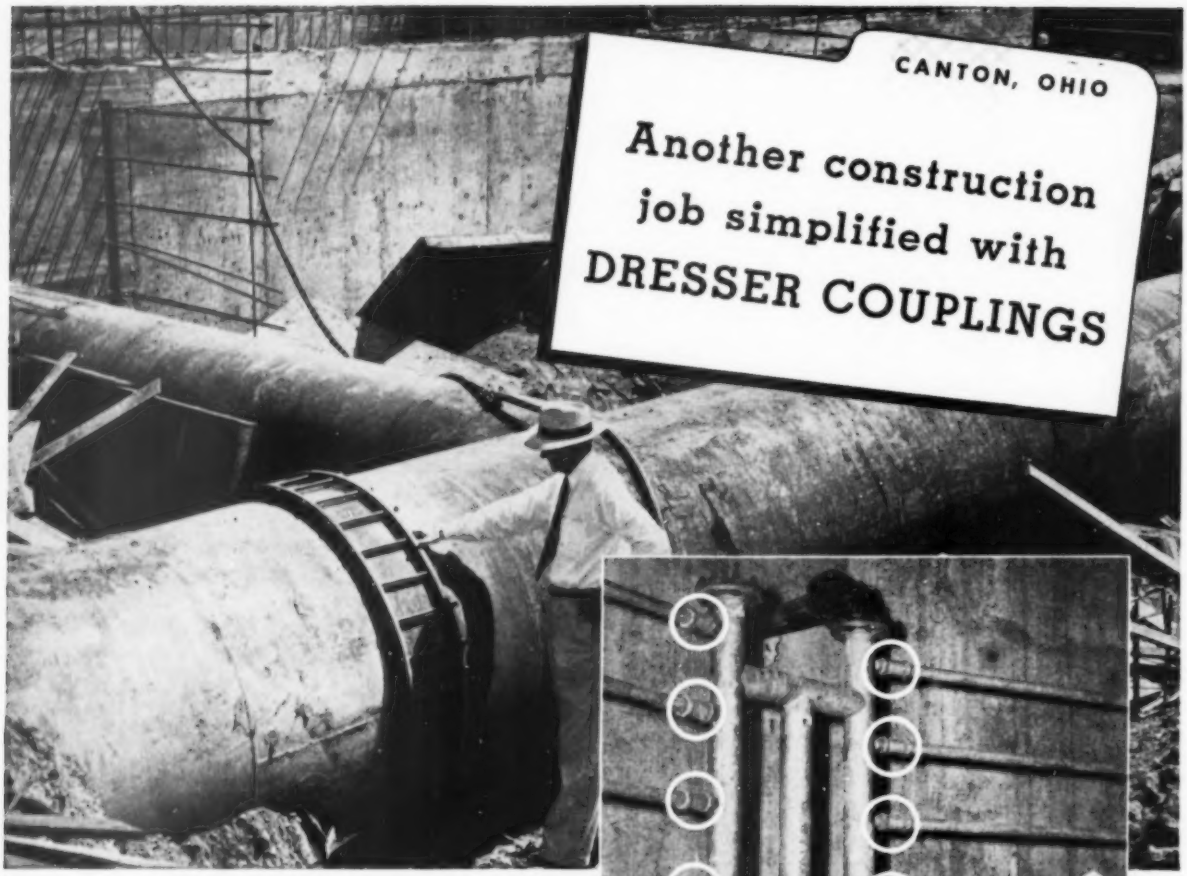
POSITION _____

COMPANY _____

STREET AND NUMBER _____

CITY _____ ZONE ____ STATE _____

WS-7



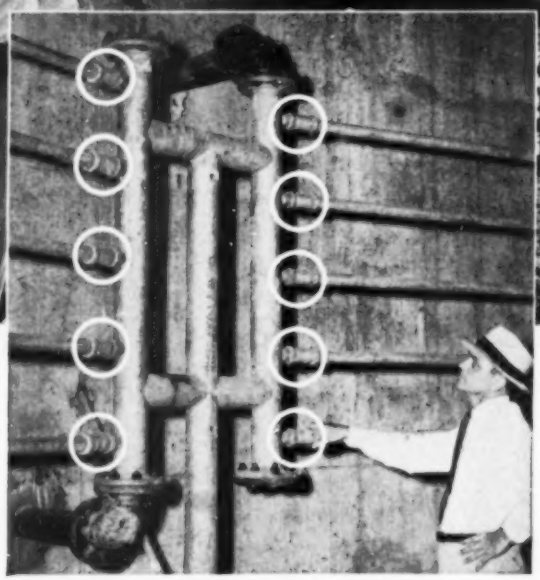
Canton sanitary engineers find the easiest way to solve difficult piping problems is also the most dependable . . . with Dresser Couplings

One of the construction problems at Canton, Ohio's Sewage Treatment Plant was installation of a special welded tee on the effluent line between grid house and primary tanks.

The use of 54" Style 38 Dresser Couplings made the installation relatively simple. Workmen, with a minimum of skill and heavy equipment, quickly made permanently tight Dresser joints.

Recognizing the many applications for versatile Dresser Couplings throughout the plant, Canton engineers greatly simplified tough, close-quarter piping installations.

Write today for more information on how Dresser Couplings can save *you* time and money on water, sewage and industrial waste projects.



Hot water heating coils completely encircle the interior walls of six large digester tanks in the Canton Plant. 450 Dresser Style 65 Compression Couplings were used to absorb expansion-contraction of piping and to simplify close-wall installation.

DRESSER® COUPLINGS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries). Warehouses: 1121 Rothwell St., Houston, Texas; 101 S. Bayshore Highway, South San Francisco, California. Sales Offices: New York, Philadelphia, Chicago, Houston, South San Francisco. In Canada: Toronto, Ont.

Complaint Insurance

Your best insurance against consumer complaints is to keep an adequate supply of Aqua Nuchar Activated Carbon on hand. Then, when a sudden taste or odor appears, it can be quickly controlled by increased dosages of carbon. But remember, do not attempt, during short periods of very intense tastes and odors, to get by with an insufficient dosage. Be sure to use enough Aqua Nuchar to do the job during these periods. To do otherwise would definitely represent false economy when measured in long-range consumer relationships.

Many water plant operators control tastes and odors and their customers' tempers by constantly feeding small amounts of Aqua Nuchar Activated Carbon. This lays the groundwork for a quick increase in dosage of Aqua Nuchar to counteract any sudden intensification of tastes and quickly restore the palatability of the water.

Liqro Crude Tall Oil • Indusoil Distilled Tall Oil
Tallene Tall Oil Pitch • Tallex Abietic Acid • Indulin (Lignin)

industrial CHEMICAL SALES
division west virginia pulp and paper company

NUCHAR

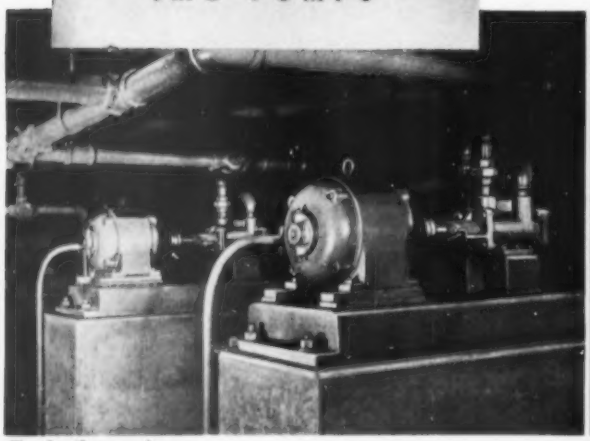
New York Central Building
230 Park Avenue
New York 17, N.Y.

Lincoln-Liberty Building
Broad and Chestnut Streets
Philadelphia 7, Pa.

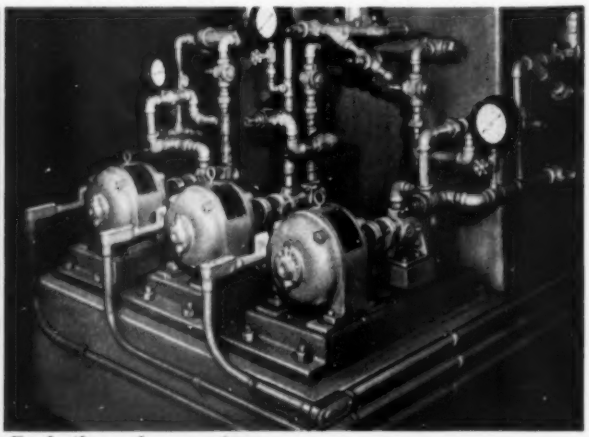
2775 S. Moreland Blvd.
at Shaker Square
Cleveland 20, Ohio

Pure Oil Building
35 E. Wacker Drive
Chicago 1, Ill.

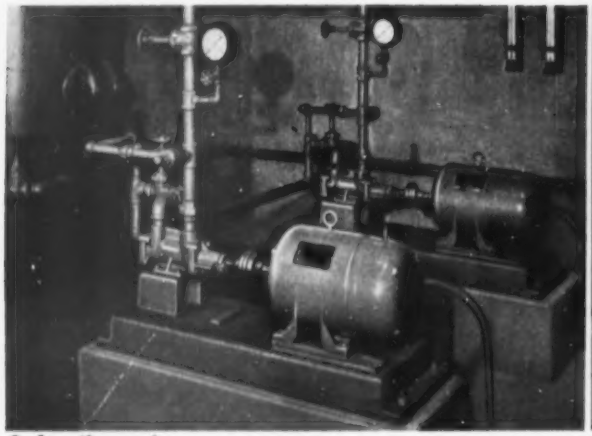
DE LAVAL IMO PUMPS *hold down 4 jobs at Owl's Head*



Fuel oil transfer



Fuel oil supply to engines



Lube oil transfer

Lube oil circulating

Again De Laval IMO rotary pumps prove their versatility. Eighteen of them are handling all the fuel and lube oil services for the six National Supply Company dual-fuel engines in the new Owl's Head sewage treatment plant in Brooklyn, New York.

The unique IMO design—*with only three moving parts*—assures long, trouble-free performance. IMO pumps are quiet, pulsation-free, compact and excellent for direct-connected high-speed operation.

Whether your power source is dual-fuel, gas or diesel engine, or oil-fired steam, be sure to specify IMO pumps for your next oil handling job. Use them in high and low pressure fuel oil burner sets, pumping fuel oil to burners, unloading and transferring fuel and diesel oil, handling oil for lighting off service and providing pressure lubrication on pumps and turbines. Send for Bulletin LG showing complete IMO line for capacities to 1,000 gpm at pressures to 500 psi and for capacities to 150 gpm at pressures to 1,500 psi.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY
824 Nottingham Way, Trenton 2, New Jersey

DL 157

MONO-CAST Pipe for Every Service Condition

Modern usage is continually making increasingly severe demands on pipe lines. Underground mains must do much more than merely resist corrosion. They must convey greater volumes, at higher internal pressures; they must withstand vastly increased external loadings; they must be adapted to an ever-widening range of service conditions. Mono-Cast Pipe possesses the exceptional physical strength and uniformity necessary to meet these requirements.

Mono-Cast Pipe is manufactured under rigid specifications in diameters 3-inch through 48-inch. It will stand the impact of heavy loads and gives complete job satisfaction. This pipe is manufactured in specific weights for specific laying conditions. You get the exact pipe your conditions require.

It is conveying sewage, water, gas, crude oil, gasoline, sour naphtha, salt brine, Foamite fire foam, ashes —and in fact, just about everything that a pipe line can conceivably convey. It is conveying these products under operating pressures ranging from a few pounds to the square inch, up to pressures in excess of 100 pounds gas and 500 pounds liquid.

Mono-Cast Pipe serves equally well beneath crowded city streets or in sewage treatment plant installations, like the one shown above.

Being cast iron, Mono-Cast Pipe enjoys an enviable reputation. Cast iron pipe has had over three hundred years of service abroad and more than one hundred years of service in the United States. It is satisfactorily serving in locations where especially severe external and internal corrosion conditions exist. Mono-Cast Pipe is designed to give super-service and its wide acceptance and splendid performance bespeak its excellence and the confidence and esteem in which it is held by those who are using it.

Refer your next piping job to ACIPCO, and utilize the extensive manufacturing facilities of the largest individual cast iron pipe foundry in America.

Write for free literature.

AMERICAN CAST IRON PIPE COMPANY

BIRMINGHAM 2, ALABAMA

Dallas Houston El Paso Pittsburgh Kansas City New York City
Chicago Minneapolis Cleveland Los Angeles San Francisco Seattle Denver

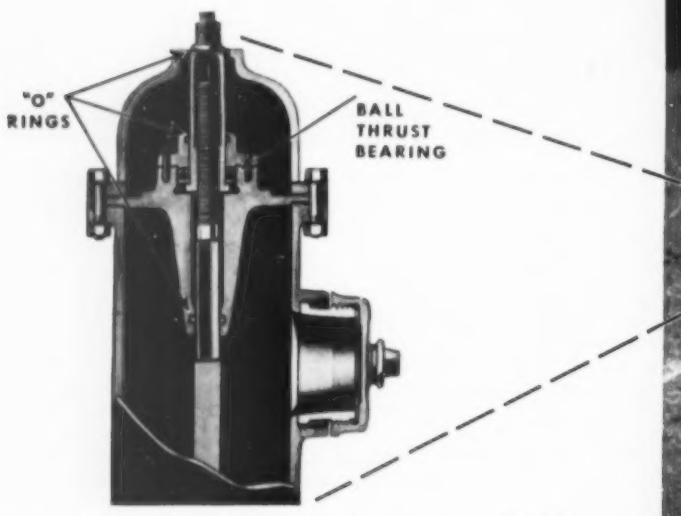
In Cuyahoga Falls...

Darling hydrants for 45 years ...now DARLING B-50-B's are going in!

EASIER maintenance and rugged construction . . . basic design advantages of Darling hydrants and valves . . . have been paying off in Cuyahoga Falls, Ohio, since way back in 1908. In the words of City Engineer T. H. Sauter, "The City of Cuyahoga Falls has been a user of Darling hydrants and valves since 1908. The ease with which repairs can be effected has been a factor in the determination of the city to standardize on this type of equipment."

Darling B-50-B's Bring Unique, New Advantages!

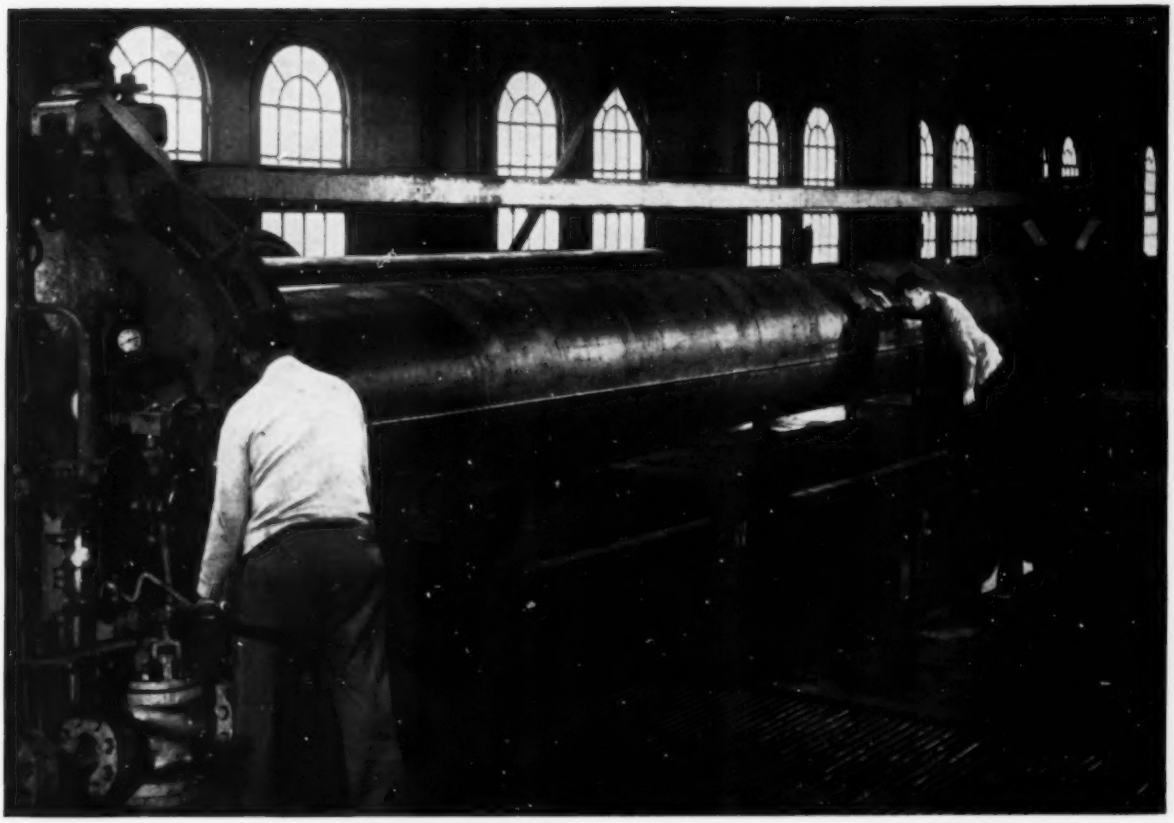
Cuyahoga Falls, and hundreds of other cities too, are now installing the new Darling B-50-B hydrants. This dry-top, ball-bearing hydrant opens quicker, operates easier, and eliminates bothersome packing lubrication. Moreover, the special Darling B-50-B "O" rings are insurance against loss of lubricant for threads and bearings . . . *and never let a drop of water reach the operating threads.*



Before you decide on any hydrant or valve, get all the facts on the new Darling B-50-B hydrant and Darling water valves for every service. *Write today!*

DARLING VALVE & MANUFACTURING CO.
Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford 7, Ontario



Why You Can Be Sure about The Strength of Steel Pipe

The photograph shows a 40-ft length of Bethlehem Steel Pipe undergoing a hydrostatic test at our Steelton, Pa., plant. This test is carried out in accordance with AWWA requirements, the pipe being subjected to a test equivalent to 200 pct of the working pressure.

Each length of Bethlehem Pipe, whether for water- or sewage-line service, is tested in this way to prove its strength and water-tightness. The test also shows conclusively why Bethlehem Tar-Enameled Steel Pipe is a reliable pipe for any type of sewage line.

In addition to its strength and water-tightness, Bethlehem Tar-Enameled Pipe has these other worthwhile advantages:

It resists corrosion, because the pipe is lined and coated with a smooth, uniform layer of coal-tar enamel. The lining, being impervious to corrosion and incrustation, ensures high flow-coefficients for the life of the installation.

It is also resistant to water-hammer. It can carry a load of nearly four times the working pressure. In addition, it has the resilience to "give" with soil movement, making it immune to the effects of surface vibrations.

Bethlehem Tar-Enameled Pipe can be joined into a tight, sound line by mechanical couplings, or by welding or riveting. The pipe is generally furnished in 40-ft lengths. It comes in diameters from 22 in. i.d. through 150 in. i.d., and in thicknesses to accommodate any working pressure.

Perhaps you would like to have complete information about Bethlehem Tar-Enameled Pipe. If so, all you need do is drop a line to the nearest Bethlehem office.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM *Tar-Enameled* STEEL PIPE

Research and Development bring you this finer-than-ever pipe

You can't better a product like cast iron pressure pipe—with its unparalleled record of long life, economy and efficiency—by waving a wand. Yet the story of how the best product in its field has been made *still better* can be told in a paragraph.

***Modernized* cast iron pipe is a result of the sum total of recent product and process improvements attained by research and development.**

It is centrifugally-cast and, when needed, centrifugally cement-lined. It is tougher, stronger, more uniform in quality. It is tuberculation-proof with sustained carrying capacity for the life of the pipe.

If you want the most efficient and economical pipe ever made for water distribution, your new mains will be laid with *modernized* cast iron pipe with either mechanical or bell-and-spigot joints. Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 122 So. Michigan Ave., Chicago 3.

This cast iron water main, uncovered for inspection, is in good condition after over a century of service in Detroit, Mich. —one of more than 45 cities with century-old water or gas mains in service.

Modernized **cast iron**

CAST Q IRON

The Q-Check stencilled on pipe is the Registered Service Mark of the Cast Iron Pipe Research Association.

pipe *for Modern Waterworks Operation*

Sewage Pump Well Elevation Held at 114.5′±3″ Despite Big Variations in Flow

Three of four E-M 200 hp, 1200 rpm Vertical Synchronous Motors with Adjustable-Speed Magnetic Drives at Nut Island Sewage Treatment Plant of the South Metropolitan Sewage System in Quincy, Massachusetts.

E-M Vertical Synchronous Motor and Magnetic Drive Unit for adjustable-speed power transmission to vertical centrifugal pump. The ring element (1) mounted directly on the motor shaft turns at motor speed. The magnet element (2), mounted inside the ring element, has no mechanical connection to the motor . . . torque is transmitted through magnetic flux linkage between ring and magnet. By varying amount of excitation to magnet, pump speed can be precisely controlled.

AMAZINGLY PRECISE CONTROL OF SEWAGE PUMPS OBTAINED WITH E-M ADJUSTABLE-SPEED MAGNETIC DRIVES

One of the critical problems in operating Boston's new Nut Island Sewage Treatment Plant is complete control over the wide daily, weekly or seasonal flow variations. For example, flows may vary from 63 mgd to 249 mgd, with peak loads of nearly 300 mgd during stormy periods.

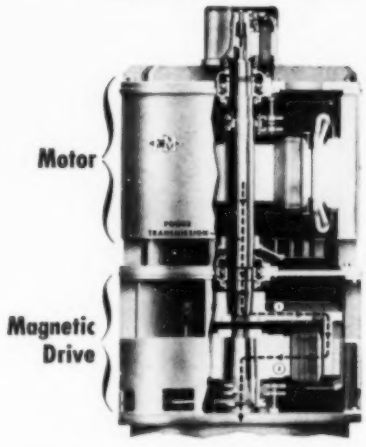
The pump well has to maintain an elevation of 114.5 feet with not more than 3 inches variation, to assure proper levels and flow velocities in the sewage processing channels. Control of the output of the low-lift sewage pumps has to be fast and remarkably accurate.

Use of E-M Adjustable-Speed Magnetic Drives for the low-lift pumps provides the sensitive speed control necessary in maintaining this close command of the pump well elevation.

Pump speed changes are dictated by a well float that actuates the Magnetic Drive through an E-M "Regutron" Control. Pump speed is automatically increased or decreased to maintain precisely the required pump well elevation. The Magnetic Drives are highly important and effective factors in most efficient operation of the Nut Island Sewage Treatment Plant for eliminating pollution in Boston Harbor.

For more information, see your nearest E-M sales engineer. And write direct for a copy of E-M Synchronizer No. 38 which tells the complete story of this outstanding installation.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA



E-M

Specialists in making motors do
EXACTLY WHAT YOU WANT THEM TO

4400-TPA-2149

NEW LIGHT ON AN OLD SUBJECT*

Bringing new light to bear on the varied uses of

its products is part of Niagara's service to industry.

NIALK® Liquid Chlorine

For nearly fifty years, many American communities have depended on NIALK Liquid Chlorine for the safe, efficient purification of water. Niagara Alkali pioneered in the production of liquid chlorine in this country, and in its use for water purification.

Quality plus cooperation keeps NIALK products at the forefront in research and product improvement.

NIAGARA ALKALI COMPANY

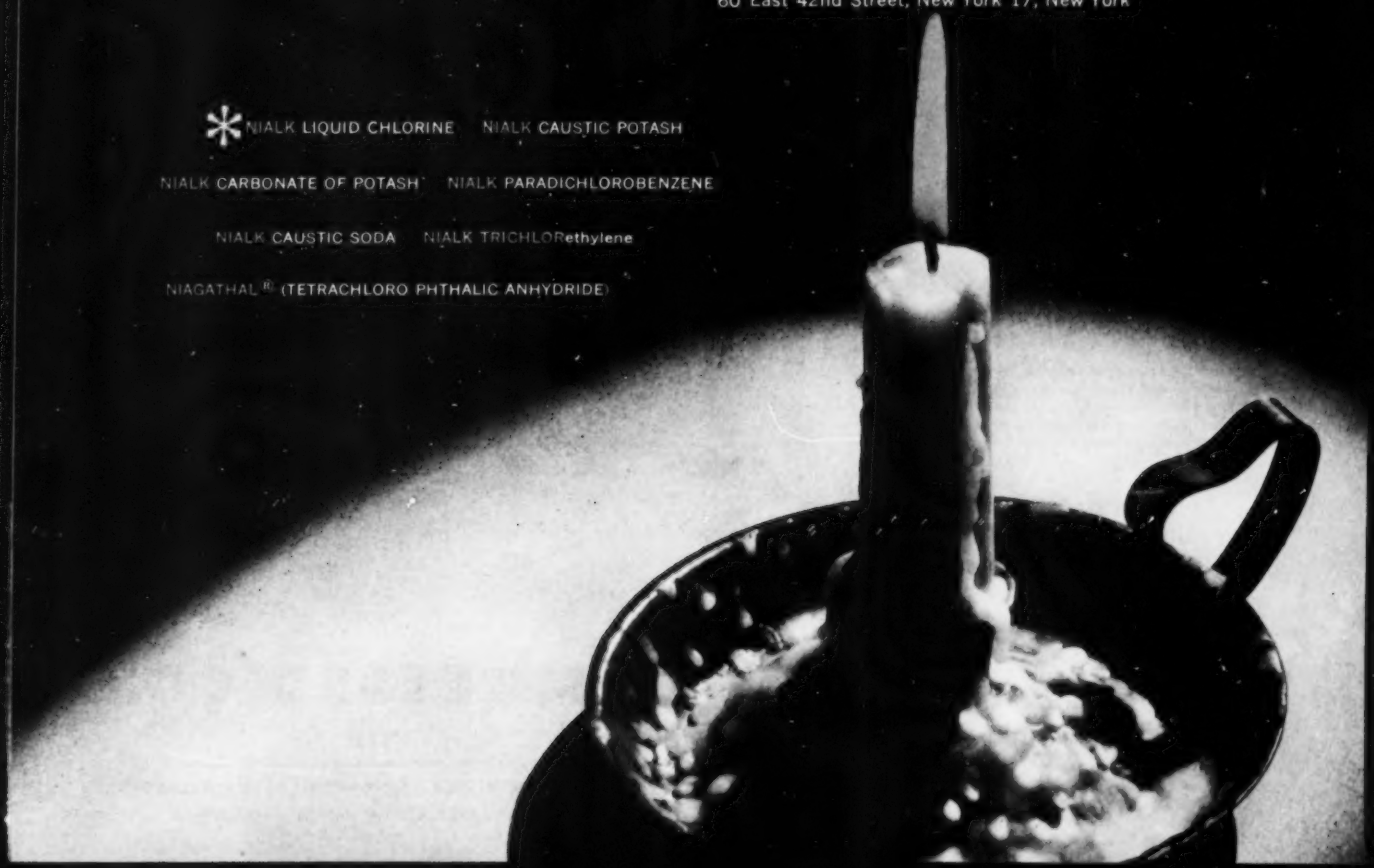
60 East 42nd Street, New York 17, New York

*NIALK LIQUID CHLORINE NIALK CAUSTIC POTASH

NIALK CARBONATE OF POTASH NIALK PARADICHLOROBENZENE

NIALK CAUSTIC SODA NIALK TRICHLORethylene

NIAGATHAL® (TETRACHLORO PHTHALIC ANHYDRIDE)

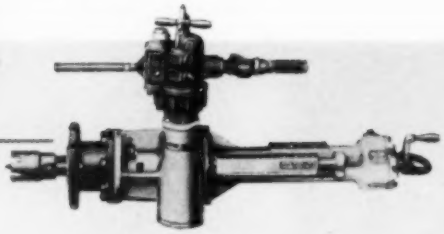


MUELLER®

FOR THE FINEST IN WATERWORKS EQUIPMENT

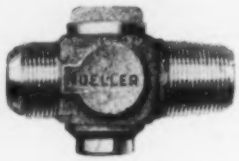
"B" Tapping and Inserting Machine

Drills and taps mains and inserts corporation stops, ½" to 1", under pressure...may be used on dry taps, ⅜" to 2½"...similar machines available in larger sizes.



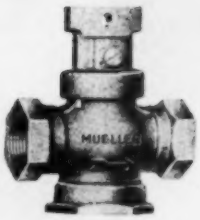
"C-1" Drilling Machine

Makes cuts 2" to 12" in any size main... dry or under pressure...power-operated with H-600 Air Motor or H-602 Gasoline Engine Drive Unit...hand-operated model also available.



Corporation Stops

Designed for insertion in mains under pressure with Mueller Tapping and Inserting Machines...wide range of sizes and types...variety of inlet threads ...fully tested.



Curb Stops

Ground key stops...steeper taper on key prevents sticking and allows easy operation...inverted key or solid tee head type available...wide range of sizes ...fully tested.

Service Clamps

Designed for cast iron, steel, asbestos cement, or wrought iron pipe...double or single strap...full length threads ...neoprene or lead ring gaskets ..wide range of sizes and tappings.

Meter Setting Equipment

Copper or iron meter yokes...flat head or lock wing angle stops...meter couplings ..complete line available...variety of threads and outlets.

Gate Valves

Exclusive four-point contact wedging mechanism assures positive seal...fully bronze mounted...maximum corrosion resistance...conventional packing or "O" Ring Seals...rising or non-rising stems A.W.W.A.

Fire Hydrants

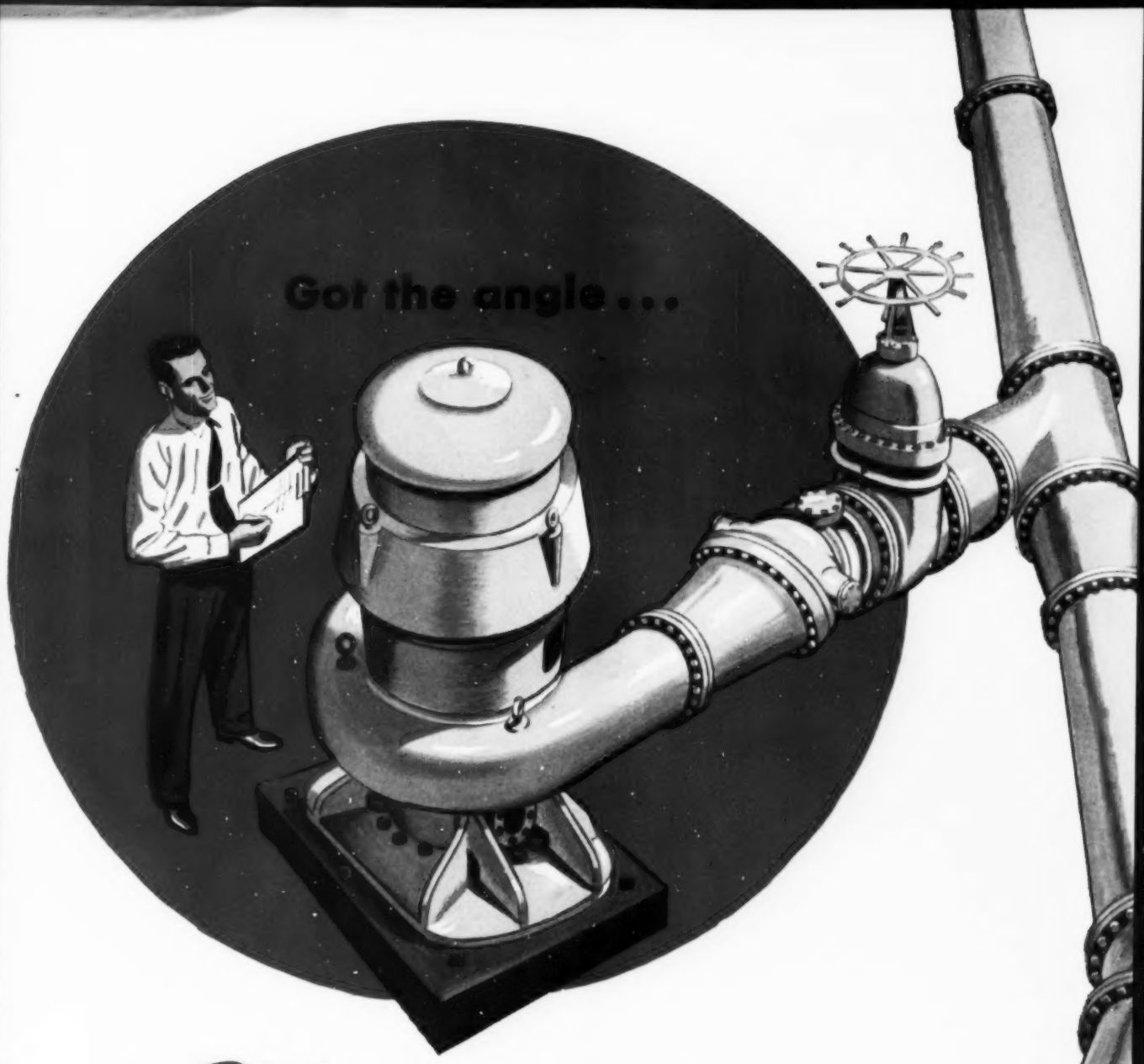
Improved and standard types...designed and built for long life and trouble-free service ..safety flange reduces collision damage... A.W.W.A.

▶ These products are just a portion of the complete selection of waterworks equipment, supplies and specialties offered by Mueller Co. and designed and manufactured to their characteristically high standards.

MUELLER CO.

Dependable Since 1857

MAIN OFFICE & FACTORY DECATUR, ILLINOIS



for BIG volume pumping?

You get a new high in service from Fairbanks-Morse *Angleflow* Pumps. They're designed for BIG volume pumping against moderate heads — sizes range from 8 to 54 inches . . . capacities up to 80,000 GPM.

You can move big volumes of sewage or storm water too, with *low* operating and maintenance costs. These Angleflow Pumps, with their wide, unobstructed impeller and volute passages, are especially suitable for handling debris-filled water.

For information, see your local Fairbanks-Morse Pump Engineer . . . or write Fairbanks, Morse & Co., Chicago 5, Illinois.

FAIRBANKS-MORSE

a name worth remembering when you want the best

PUMPS • SCALES • DIESEL LOCOMOTIVES AND ENGINES • ELECTRICAL MACHINERY
RAIL CARS • HOME WATER SERVICE EQUIPMENT • FARM MACHINERY • MAGNETOS

• Here in this one box are the repair parts recommended for a city placing 1,000 meters in service. Individual parts as well as complete assemblies are interchangeable, in all meters supplied during the past 30 years.

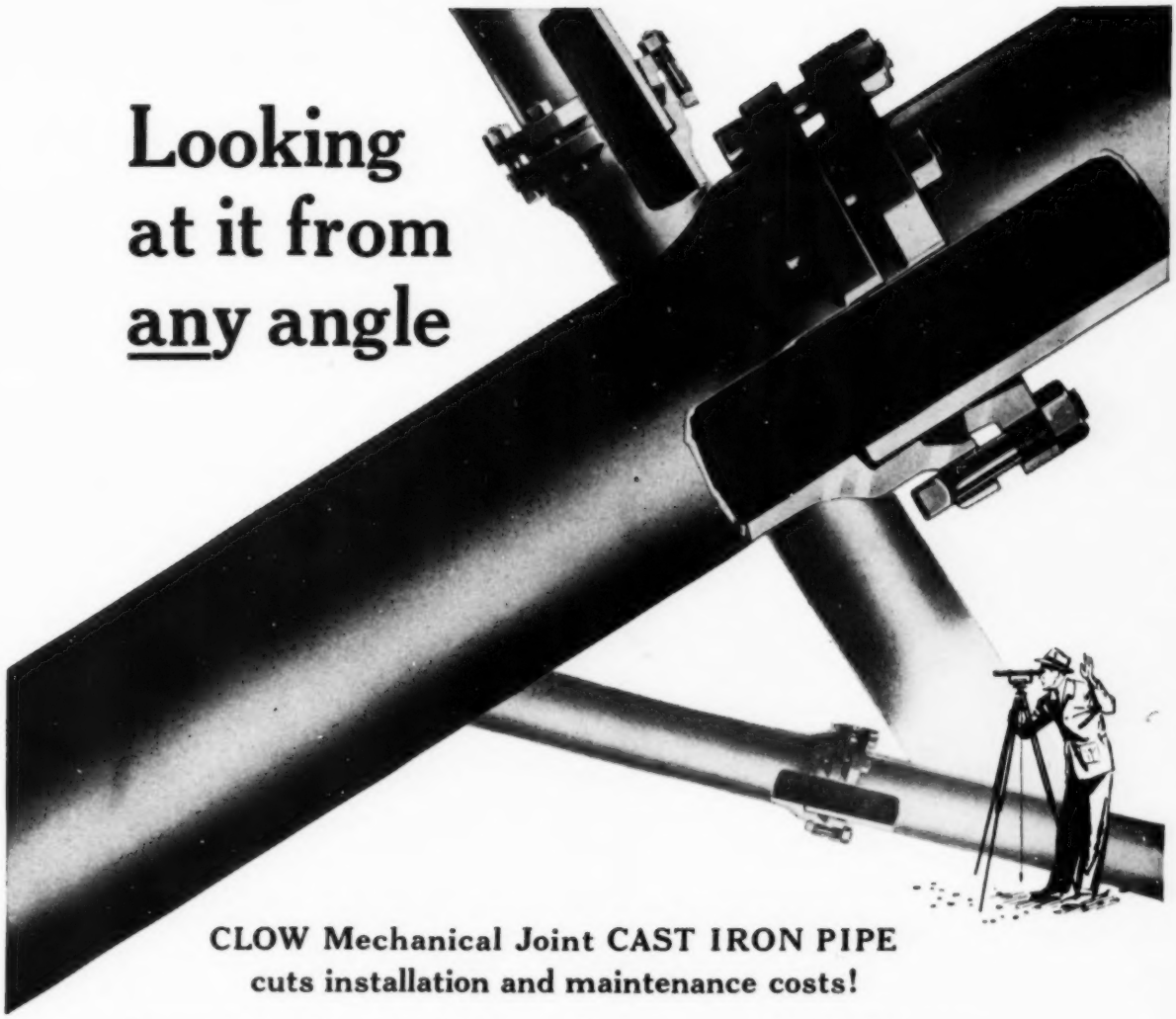
Improvements have been made in the construction of parts and in metallurgy to improve operation and increase life. But parts remain fully interchangeable to save your dollars. American Meters are still the simplest with the fewest parts.

Ask for complete data.

BUFFALO METER CO.

2909 MAIN STREET, BUFFALO 14, NEW YORK

Looking at it from any angle



CLOW Mechanical Joint CAST IRON PIPE cuts installation and maintenance costs!

Economy in installation and maintenance is a first consideration with every waterworks superintendent, and — in every way — that's what Clow mechanical joint cast iron pipe gives you.

Fast installation . . . rain or shine. Clow mechanical joint pipe cuts costs right from the start by saving time and labor on installations. No calking is required. Ordinary workmen with ratchet wrenches can do the job in record time, even in wet trenches or under water.

"Bottle-tight" joints with "floating flexibility." Every joint is sealed tight as a corked bottle by a heavy rubber gasket confined within the bell under pressure, yet the joint remains free-floating and flexible to compensate for vibration, expansion and contraction. This means a leak-free, trouble-free installation . . . cuts maintenance costs.

Long life at low cost. Clow mechanical joint cast iron pipe goes right on saving money through a century and more of service. This is *true* permanence . . . and true economy.

Clow mechanical joint cast iron pipe is available in 18-foot lengths, sizes 3" to 24". Write TODAY for helpful, detailed information—Form 12-18-50.

CLOW FOUNDRIES are equipped to produce Bell and Spigot Joint cast iron pipe, fittings, valves and many pipe line specials.

JAMES B. CLOW & SONS ☆

201-299 North Talman Avenue • Chicago 80, Illinois

and their National Cast Iron Pipe Division, Birmingham, Alabama.

Subsidiaries:
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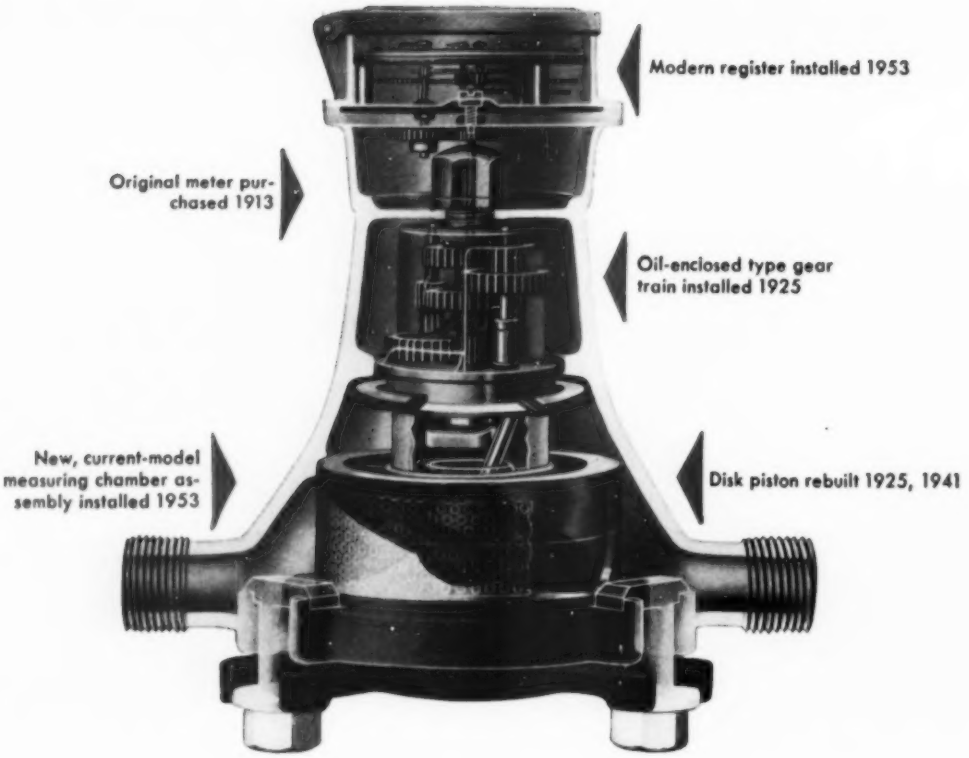
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WATER & SEWAGE WORKS

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CEDAR RAPIDS' water softening and filtration plant

Corrosion Control Experience in Cedar Rapids, Iowa

Improvements are Credited to Higher pH Value, Phosphate Treatment, and Flushing Program

by **ARNOLD K. CHERRY,** ***Chemist, City Water Works, Cedar Rapids, Iowa***

THE current trend in water softening treatment generally involves two steps: (1) raising the pH value in an attempt to inhibit corrosion in the distribution system, and (2) applying polyphosphates to prevent too much deposit of calcium carbonate in cold water lines near the plant. Cedar Rapids has followed this trend rather cautiously, trying to minimize filtration problems and at the same time keep complaints to a minimum.

Procedure 1930 to 1943

Following is a brief summarization of operational procedures in Cedar Rapids since water softening was started in 1930. Water obtained from the Cedar River was treated in two stages, usually softening in the first mix and clarifier followed by a second coagulation and settling. The water was recarbonated only once, to maintain an average pH value of 9.0 to 9.2, just before filtration. The average alkalinity reduction through the filters was 15 to 20 ppm, and the pH value was reduced to between 8.5 and 8.75. As a result, the sand grains began to increase in volume and, by 1935, appeared more like tapioca than filter sand.

In an attempt to stop this incrustation, recarbonation was increased to carry the pH on the filters at an average value of 8.8 in 1935, 8.7 in 1936 and 8.6 in 1937. The average of the plant effluent during these years was between pH 8.4 and 8.5.

The filter sand was removed and replaced in 1936 and 1937, and the next few years, if we look back at the records, seem to be ones of caution. The water on the filters averaged 8.7 to 8.9 in pH value, the plant effluent 8.5 to 8.6, and the alkalinity reduction through the filters was negligible. The filter sand remained in good shape, but the average plant effluent alkalinity for the years 1937 through 1942 was 56 to 64 ppm.

Increased Alkalinity Reduction

In 1943, when the author first became interested in the treatment, it was decided to attempt a higher degree of water softening and, at the same time, to reduce the load on the filters. Recarbonation was instituted in the middle of the process, allowing several hours settling at a pH value where calcium carbonate is quite in-

DETERMINATION of phosphate in water samples
The author using an electrophotometer to measure phosphate concentration.

soluble (about pH 10.0). The result was an immediate reduction in alkalinity.

The yearly averages for the next several years were between 38 and 45 ppm alkalinity; being high in the winter when softening action is slow, but below 30 ppm for considerable periods. The pH value was increased to 9.2 on the filters, and the plant effluent averaged about 9.1. The alkalinity reduction through the filters was 5 to 9 ppm.

Sodium Silicate Application

Beginning in 1943 calcium carbonate stability tests were made on samples throughout the system. It was found that despite a good positive index near the plant, the water at the ends of the system often tested negative, with pH's of below 8.0 not uncommon. The pH value was increased as high as we considered feasible, still being cautious of filter sand incrustation. Then, at intervals during 1945 and 1946, experiments were conducted with sodium silicate. The alkaline material was applied in the clear well and was beneficial in increasing the pH value of the water after filtration.

Even though the dosage applied was only 7 to 11 ppm of a material containing about 29 per cent SiO_2, silica scale caused the local power company some trouble. Sodium silicate application was discontinued when it was decided that its benefits were insufficient to warrant the cost.

For the next two or three years pH values were varied, and soda ash was added in the clear well when the alkalinity was low in order to increase the pH value and thus convert calcium sulfate to calcium carbonate. The control of alkalinity by introducing raw water into the final mixer was also attempted. This did not prove satisfactory in the summer when tastes and odors are a problem, and when turbidities often increase several hundred parts per million in a few hours. It was a difficult problem: the higher the pH value was carried on the filters, the more reduction there was in alkalinity; the lower the alkalinity of the plant effluent, the higher the pH had to be carried to maintain the proper stability index.

Rusty Water Problem Severe in One Area

Rusty water complaints were not too much of a problem except in one area of the city. This district is supplied from an 8 mg storage reservoir by automatic pumps which maintain a fixed level in an elevated storage tank. The district is separated from the balance of the system by check valves designed to open only if power to the booster station interrupted, and causes a pressure drop. There are a number of dead ends, and the piping in the area is old. For over 25 years the residents of the district complained of being troubled with rusty water, to the extent that some gave up doing laundry at home. There was a standing order to flush hydrants in one locality every Friday afternoon. Despite this frequent flushing, the iron content of the cold water was never less than 0.4 ppm.

Sodium silicate application, at the booster station, relieved this situation somewhat but not completely. In May of 1949 sodium hexametaphosphate was given a trial. For the first four weeks complaints increased, and we were about to return to silicate treatment when conditions began to improve. Since that time, about 2.0 ppm phosphate has been carried in this district; the chemical being applied to the suction side of the booster pumps. The cost of the chemical required is definitely less than the cost would have been if the frequent flushings were continued. Periodical checks are made at four sampling points in this district for alkalinity, pH, total iron, dissolved oxygen and phosphates. The results have been completely satisfactory; not one of the samples collected from this area during 1952 showed more than a trace of iron in the cold water.

Experience With Hexametaphosphate

In February of 1950 sodium hexametaphosphate feed was started at the plant. It was found that an application of 0.5 ppm, in water applied to the filters, stopped the softening action through the filters. By applying the chemical to a varying number of filters it was possible to control the alkalinity and pH value at any desired point. The feed has been continuously maintained at 0.5 to 0.75 ppm, either on the filters or in the clear well.

Now that a fluoride compound is being applied to the water it is necessary to feed the phosphate into the fluoride mixing pot in order to prevent the formation of calcium fluoride in the clear well, therefore the application is usually at this point. For a time during the summer of 1952 the dosage was divided between the filter influent and the fluoride pot by using two pumps.

The small application of sodium hexametaphosphate had the immediate effect of maintaining alkalinity and pH value of the water in the far ends of the system at practically the same level as that of the plant effluent. With the carbonate deposition in the mains practically stopped, we were then afraid that there would be insufficient protective film formed in the mains and the cold water lines. However this has not proven true. In areas of poor circulation, such as dead ends, the phosphate treatment has proven particularly advantageous. The gradual reversion from meta-to orthophosphate apparently allows sufficient deposition to protect the pipes.

Reversion to ortho-phosphate (as

shown by samples collected from representative testing points throughout the system) averages 40 per cent; in some samples collected from locations far from the plant, reversion is 80 per cent complete. We also theorized that the phosphate application might relieve some of the hot water tank corrosion problems. It might do this by keeping the carbonates in suspension until the rapid reversion to orthophosphate, caused by high temperatures maintained in the tanks, allowed the formation of a protective calcium film.

Since the application of sodium hexametaphosphate at the plant less bicarbonate has been carried on the filters. The average pH value of the plant effluent has been increased to about 9.6, thus giving a higher Langelier stability index. There have been no filtration difficulties experienced with this treatment to date. The wash water used in recent years has averaged 2 per cent or less of the total water filtered. The sand in four old filters (in use for over 15 years) has not grown to any appreciable extent, the effective size now being about 0.6 mm.

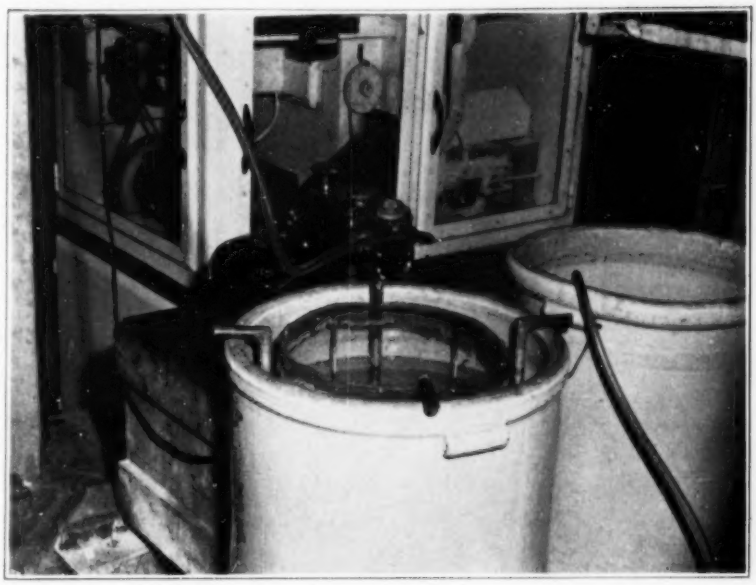
Return Sludge Treatment

The average characteristics of plant effluent in the past year have been as follows:

Total alkalinity	34.5	ppm
Phenolphthalein alkalinity	11	"
Total hardness (As $CaCO_3$)	86	"
Calcium (As Ca)	23.6	"
Magnesium (As Mg)	6.6	"
Total solids	138	"
pH	9.6	

During 1951 a plant extension program was completed[1,2] which increased the filtration capacity of the Cedar Rapids plant from 12 to 24 mgd. In the first year of operating the new plant there were a number of mechanical difficulties to solve. New clarifiers and mixers were out of service for repairs and adjustments, and old basins were out of service the majority of the summer of 1952 for cement repair work and clarifier rebuilding.

With all basins operating, the plant is very flexible and operates satisfactorily using a return sludge-split treatment, providing the taste and odor problem is not too great. The average threshold odor of the river last year was 17. Long detention periods are provided and our experiences have indicated a table water can be obtained on the filters with this treatment. In fact, water having received the benefit of returned sludge has been filtered at a pH of 10.0 with a drop of a very few parts per million of alkalinity, indicating little filter incrustration to take place.



A PHOSPHATE solution feeder

Each feeder draws from one of two solution crocks. Note dissolving basket used to prepare new solution.

Consumer Complaints

Evaluating the efficiency of a treatment to minimuze corrosion requires not only analyzing the water from a number of sampling points, but also the investigation of all consumer complaints.

Years ago it was the attitude of the water department that its obligation should cease when the water left the main distribution system. Rusty water complaints were disposed of in one of two ways: a cold water complaint was turned over to the distribution service crew for flushing at the nearest hydrant, hot water compaints were easily explained over the telephone: if the rust wasn't present in the cold water it must be caused by old or defective plumbing. Today every complaint coming to our attention is investigated by a member of the laboratory force.

A record of recent years shows the following number of complaints:

1947	88
1948	101
1949	103
1950	57
1951	23
1952	35

The figures given for 1947 through 1949 are based on the number of orders requiring flushing of mains because of rusty water complaints. No hot water tank complaints were included during those years. The figures for 1950 through 1952 include all complaints received. An analysis of the complaints received in 1952 follows:

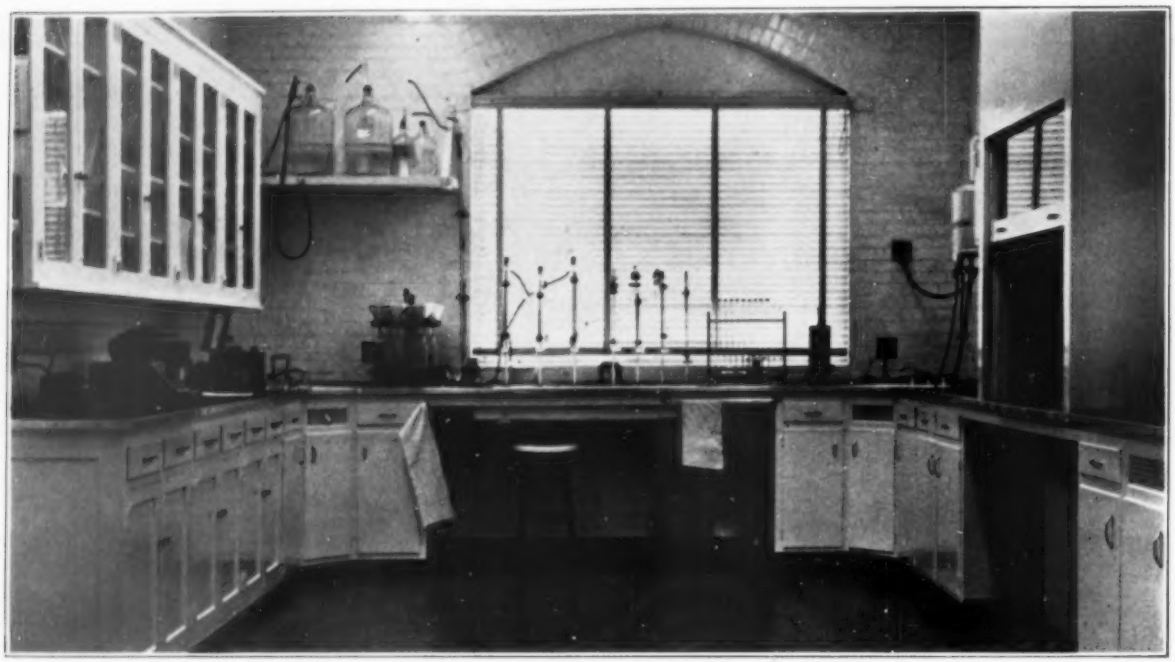
Cause found to be:	Number
Street flushing	7
Water softeners	6
Old or defective hot water tanks	5
Galvanic action (dissimilar metals)	4
Temperature of hot water tank too high	4
Distribution system (Operating valves or cutting in on mains)	2
Dead End Needed Flushing	2
Undetermined	5
Total	35

It will be noticed that street flushing caused the majority of cold water rust complaints because just enough water was drawn at a high velocity to stir up the rust before shutting off the hydrant.

Rusty water complaints caused by household softeners are probably the easiest to handle. Installation of Micromet* feeders is our recommendation to the consumer who complains about the corrosiveness of the water after softening to zero hardness. These feeders supply phosphate in sufficient quantity to protect hot water tanks in the absence of calcium carbonate after water has been zeolite softened. The only reports of premature failure of hot water tanks have been at locations using water softeners. There are few of these installations in the city, as our water hardness averages only about 5 grains per gallon.

A few complaints have been received from nearly new homes with copper piping. This difficulty could be traced to the installation of dissimilar metals somewhere in the lines, causing galvanic corrosion. In some cases

*Product of Hall Laboratories, Pittsburgh, Pa.



CHEMICAL LABORATORY of the Cedar Rapids plant

removal of one iron fitting from a copper line can be responsible for the difference between a satisfactory water and one unfit for washing.

Water Heater Problems

Our corrosion control program seemingly is not too effective when hot water storage tank temperature exceeds 150° F. Rusty water complaints caused by excessive temperature are becoming more prevalent, as there are today more automatic hot water tank installations. The automatic laundry and dishwashing machines coming into wider use require quantities of high temperature water. Manufacturers are equipping their tanks with thermostats permitting maintenance of 180° F. temperatures. Many consumers purchase the cheapest tank on the market, often with only a 20 gallon capacity. They then find it necessary to keep the thermostat set as high as possible, diluting the hot water with cold to obtain the desired quantity. One good example of an undersized heater which recently came to our attention through a complaint, was a 20 gallon tank supplying a family having 10 children.

Little information has been gathered in Cedar Rapids on the value of cathodic protection of household storage tanks by the use of magnesium alloy anodes. However, in one case coming to our attention, a consumer troubled with rusty water due to high temperatures in a 20 gallon hot water tank, installed a magnesium rod at the recommendation of his plumber. Our test before installation showed 0.1 ppm of total iron while one year later, on a recheck, iron was absent in the hot water; the consumer stated that the trouble was eliminated shortly after the installation was made.

Routine Flushing Program

It will be noted that there were few calls requiring the flushing of mains in 1952. This is due in part to the flushing program instituted two years ago. The mains are now flushed twice a year, in the spring and in the fall, under the direction of the laboratory. The distribution system is flushed in about 500 locations, including all dead end hydrants and blow off valves. In former years the flushing was performed by meter service men or construction crew employees when their work would permit, which was seldom. The system was never completely covered, most flushing being the result of consumer complaint.

Since application of the phosphate treatment, the meter repair shop has noted a decided reduction in carbonate deposits in the meters, and the construction crews report coatings on the mains inspected to be adequate but not excessive.

Samples collected periodically from 20 to 25 sampling points throughout the entire system in 1952 showed an average iron content of only 0.02 ppm. Everything indicates that the rate of corrosion has definitely been reduced in the last two or three years. This improvement must be credited to several factors: increase in the pH value of the water, application of phosphate compound, and improvement of our flushing program.

The number of complaints can be considered quite insignificant considering the size of the system. Cedar Rapids has a population of about 75,000; there are about 19,000 water meters and 180 miles of water mains.

The corrosion control treatment outlined cannot be considered perfect —it undoubtedly can and will be improved. However, the decline of complaints is very gratifying considering the fact that consumers are today more conscious of minute quantities of rust in the water than ever before.

References

1. Grundler, F. E. Softening Plant Expansion at Cedar Rapids, Iowa. Water & Sewage Works, Dec. 1951, pg. 493.

2. Louis, Leo. Cedar Rapids Iowa Water Treatment Plant Features Split Treatment, American City, Dec. 1951, pg. 83.

Didya Know?

That bacteria are found living under a pressure of 6 tons/sq.in. which exists at a depth of 6½ miles in the ocean. Also, the gas pressure produced by bacteria in a closed off sludge pump has been sufficient to rupture the pump casing—at least this is the only explanation for the mysterious failure. Bacteria are also charged with the production of hydrogen-sulphide at depths of great pressure tapped by gas and oil wells.

Hydraulics of Single Pipe Lines

A Simplified Procedure

by D. R. TAYLOR, Genl. Mgr., The Baton Rouge Water Works Co.
Baton Rouge, Louisiana.

THERE are few public water supplies that are not occasionally confronted with the problem of augmenting existing distribution mains or feeder mains to serve suburban areas of doubtful future growth, or surprisingly successful subdivisions which have outgrown the capacity of present facilities.

The problem is usually one of lessening the friction loss to provide more residual pressure or of increasing the rate of flow, or both.

The purpose of this article is to present and explain a simplified solution of such problems by use of simple arithmetic. The method described provides a quick method for those who are experienced with the use of the Hazen and Williams formula and also for those who are unfamiliar with the use of logarithms, the log log slide rule or the hydraulic slide rule.

Tables have been prepared and one formula has been reduced to a form involving only squares and square roots, all to eliminate the necessity of calculations with fractional exponentials.

To solve such problems, it is necessary to know the actual diameter of the pipes involved, because nominal diameters, in some cases, do not indicate relative capacities and friction losses closely enough. For instance, some three-inch cast iron pipe is actually three and three-tenths inches in diameter with a friction loss of only sixty-three percent of that indicated by its nominal diameter. Nominal and actual diameters are shown in Table 1. The diameters used for all galvanized pipe are for standard weight steel pipe and those for cast iron pipe are for 150 pounds pressure Super-deLavaud bell and spigot and mechanical joint pipe conforming with Federal Specifications WW-P-421, except in sizes 1⅞″ to 2¼″ inclusive, which are sizes formerly or presently manufactured by several foundries and by various methods, for 150 pounds pressure or more.

The actual diameter of Super-deLavaud mechanical joint pipe is the same as that for bell and spigot pipe in sizes from 3″ to 12″ inclusive. However, the diameter differs for sizes larger than 12″. Actual diameter for both types are shown for sizes 14″ to 20″ inclusive. The bell and spigot pipe is indicated by the letters "CI" and the mechanical joint pipe by the letters "CIM."

Relative capacities and friction losses of pipes, based on actual diameters, are shown in Table 2. The main portion of the table is for galvanized steel and bell and spigot cast iron pipe. Mechanical joint cast iron pipe (indicated as CIM) is included in the table as an insert.

The upper figure in each block in Table 2 is the comparative capacity or rate of flow expressed as a multiplier. The fractional figures beneath in the same block is the comparative friction loss expressed as per cent, as compared with the capacity and friction loss of any other size of pipe shown in the vertical columns at the extreme left and right.

For instance, the capacity of a 16″ cast iron B & S pipe is 2.25 times or 225 per cent of that for a 12″ cast iron B & S pipe when the friction loss is the same. The friction loss is only .224 times or 22.4 per cent of that for the 12″ pipe for the same rate of flow. The corresponding values for 16″ cast iron mechanical joint pipe as compared with 12″ cast iron B & S pipe are 2.11 and .253 respectively (see insert Table 2).

Formulas:

When:

Q = gallons per minute
S = friction loss in pounds per square inch
D = diameter in inches
De = equivalent diameter in inches
Q_1 S_1 D_1 = values known or considered first
Q_2 S_2 D_2 = values unknown or considered second

$$Q_2 = Q_1 \left[\frac{S_2}{S_1}\right]^{0.54} \quad (1)$$

$$S_2 = S_1 \left[\frac{Q_2}{Q_1}\right]^{1.85} \quad (2)$$

$$S_2 = S_1 \left[\frac{D_1}{D_2}\right]^{4.87} \quad (3)$$

$$De = 0.92 \sqrt{D_1^2 + D_2^2} \quad (4)$$

$$Q_2 = Q_1 \left[\frac{D_2}{D_1}\right]^{2.63} \quad (5)$$

If any type of pipe is involved, other than those shown in Table 2, the actual diameter should be determined and relative capacity and friction loss calculated by formulas (5) and (3) respectively.

The Design Process

Problem 1

Assume that a 4″ cast iron main (of any length) serving one or more suburban sub-divisions has become inadequate and that it is decided to replace this main with a 6″ cast iron main.

A. What increase in rate of flow may be expected with the same friction loss?

2.88 times or 288% (Table 2)

B. What friction loss may be expected with the same rate of flow?

.142 times or 14.2%

C. What rate of flow may be expected with only one-half of the former friction loss? Assume that the former friction loss was unity (1.0).

$$Q_2 = Q_1 \left[\frac{S_2}{S_1}\right]^{0.54} \quad \text{Formula (1)}$$

$$Q_2 = 2.88 \left[\frac{S_2}{S_1}\right]^{0.54}$$

$$= 2.88 \left[\frac{.5}{1}\right]^{0.54}$$

$$= 2.88\ (.5)^{0.54}$$

From Table 4, $(.5)^{0.54} = .687$

$Q_2 = 2.88 \times .687 = 1.98$ or an increase of 98%

Table 1

NOMINAL AND ACTUAL DIAMETERS OF PIPES IN INCHES

Nominal	Actual	Nominal	Actual	Nominal	Actual	Nominal	Actual
½ Galv	.622	2 Galv	2.067	4 CI	4.12	16 CIM	16.20
¾ Galv	.824	2½ CI	2.125	6 CI	6.16	16 CI	16.60
1 Galv	1.049	2¼ CI	2.25	8 CI	8.21	18 CIM	18.20
1¼ Galv	1.380	2½ Galv	2.469	10 CI	10.16	18 CI	18.62
1½ Galv	1.610	3 Galv	3.068	12 CI	12.20	20 CIM	20.24
1¾ CI	1.875	3 CI	3.30	14 CIM*	14.20	20 CI	20.70
2 CI	2.00	4 Galv	4.026	14 CI	14.55		

* CIM—Mechanical Joint Cast Iron Pipe.

TABLE 2

RELATIVE CAPACITY AND FRICTION LOSSES THROUGH PIPES

(Based on Actual Diameters)

	½ Galv	1 Galv	1¼ Galv	1½ Galv	1½ CI	2 CI	2 Galv	2½ CI	2½ CI	2½ Galv	3 Galv	3 CI	4 Galv	4 CI	6 CI	8 CI	10 CI	12 CI	14 CI	16 CI	18 CI	20 CI	
½ Galv	2.09 .25	3.95 .078	8.1 .021	12.2 .01	18.0 .005																		½ Galv
¾ Galv		1.89 .31	3.88 .08	5.84 .04	8.7 .018	10.3 .013	11.2 .011	12.1 .01															¾ Galv
1 Galv			2.05 .26	3.08 .124	4.62 .058	5.5 .043	6.0 .036	6.4 .032	7.48 .024	9.5 .016	16.7 .005												1 Galv
1¼ Galv				1.49 .47	2.25 .224	2.66 .163	2.88 .14	3.18 .128	3.62 .092	4.6 .058	8.2 .021	9.9 .014											1¼ Galv
1½ Galv					1.49 .47	1.76 .348	1.93 .29	2.07 .258	2.42 .195	3.09 .125	5.45 .044	6.6 .03	11.2 .011										1½ Galv
1½ CI						1.18 .73	1.29 .62	1.38 .55	1.65 .394	2.05 .264	3.64 .09	4.42 .054	7.5 .024	7.9 .022									1½ CI
2 CI							1.09 .85	1.17 .74	1.36 .563	1.74 .358	3.08 .125	3.74 .098	6.3 .033	6.7 .03	19.2 .004								2 CI
2 Galv								1.08 .85	1.25 .657	1.59 .42	2.83 .145	3.42 .10	5.76 .038	6.1 .034	17.7 .005								2 Galv
2½ CI									1.16 .753	1.48 .48	2.61 .17	3.18 .12	5.38 .044	5.71 .042	16.4 .005	35.0 .001							2½ CI
2½ CI										1.28 .635	2.26 .22	2.76 .153	4.63 .058	4.93 .052	14.2 .008	30.5 .002							2½ CI
2½ Galv											1.77 .347	2.15 .24	3.62 .093	3.85 .082	11.2 .012	23.6 .003							2½ Galv
3 Galv												1.21 .70	2.08 .26	2.17 .237	6.3 .033	13.2 .008	23.2 .003						3 Galv
3 CI													1.69 .38	1.79 .34	5.15 .048	11.0 .011	19.2 .004	31.2 .002					3 CI
4 Galv														1.06 .867	3.03 .126	6.5 .031	11.4 .011	18.4 .005	29.2 .002	41.2 .001			4 Galv
4 CI															2.88 .142	6.1 .035	10.8 .012	17.4 .005	27.5 .002	39.0 .001	49.6 .001		4 CI
6 CI																2.12 .246	3.72 0.87	6.0 .036	9.6 .015	13.5 .008	18.2 .005		6 CI
8 CI																	1.75 .355	2.84 .145	4.5 .062	5.98 .036	8.63 .018	11.4 .011	8 CI
10 CI																		1.62 .41	2.57 .172	3.42 .103	4.94 .053	6.5 .031	10 CI
12 CI																			1.58 .43	2.25 .224	3.04 .127	4.0 .076	12 CI
14 CIM																				1.32 .598	1.91 .301	2.52 .18	14 CI
16 CIM																					1.35 .570	1.91 .393	16 CI
18 CI																						1.32 .598	18 CI

MECHANICAL JOINT

	14 CIM	16 CIM	18 CIM	20 CIM
4 Galv	27.5 .002	38.8 .001		
4 CI	25.9 .002	37.0 .001	49.6 .001	
6 CI	9.06 .012	12.7 .009	17.2 .005	23.0 .003
8 CI	4.23 .07	5.95 .037	8.1 .021	10.8 .012
10 CI	2.42 .196	3.42 .103	4.62 .058	6.14 .035
12 CI	1.49 .48	2.11 .253	2.86 .143	3.8 .085
14 CIM		1.41 .523	1.92 .298	2.54 .178
16 CIM			1.36 .567	1.8 .337
18 CIM				1.35 5.73

D. What friction loss may be expected with only 50% more flow? Assume that the former flow was unity (1.0).

$$S_2 = S_1 \left[\frac{Q_2}{Q_1}\right]^{1.85}$$

$$S_2 = .142 \left[\frac{1.50}{1}\right]^{1.85}$$

$$= .142 \ (1.50)^{1.85}$$

From Table 3, $(1.50)^{1.85} = 2.12$

$S_2 = .142 \times 2.12 = .301$ or only 30.1% of the former friction loss

Problem 2

Assume the same conditions as in problem 1 and assume that it is desired to replace only enough of the 1" main with 6" main to reduce the friction loss 25%.

A. What per cent of the length of the 4" main should be replaced with 6" main?

Assume that the present friction loss of the 4" main is unity or 1.0

From table 2, the friction loss of the 6" is .142

1.0 − .142 = .858, which is the difference in friction loss in per cent, for any length.

.25 ÷ .858 = .292

Therefore, to reduce the friction loss of the 4" main 25%, it will be necessary to replace 29.2% of its length with 6" main.

B. What per cent of the 4" main should be replaced with 6" main to increase the rate of flow 25% (from 1.0 to 1.25) with the friction loss remaining the same?

To increase the flow to 1.25 it will be necessary to decrease the total friction loss to a sum, that can be designated as x, which when divided into 1.0 (the present friction loss) will equal $(1.25)^{1.85}$

From table 3 $(1.25)^{1.85} = 1.51$ — see formulas (1) and (2).

Then, 1 ÷ x = 1.51, and

x = 1.0 ÷ 1.51 = .661 = desired total friction loss.

1.0 − .661 = .339 = necessary reduction in friction loss (33.9%).

1.0 − .142 = .858 (see problem 2A).

.339 ÷ .858 = .395 = 39.5% of 4" main to be replaced with 6" to increase the flow 25% with the same friction loss.

The proof of this calculation, which is also applicable to any similar problem, when proof is desired, is as follows:

If the friction loss of the present 4" main is 1.00 and 39.5% is replaced with 6" main, the friction loss of the remaining portion of the 4" main will be .605 (1.0 − .395 = .605).

The friction loss of the 39.5% of 6" will be .0561 (.395 x .142 = .0561).

The total friction loss after the replacement will be.

for the 4"	— .6050
for the 6"	— .0561
Total	— .6611
1.0 ÷ .6611	= 1.51

$Q_2 = (1.51)^{0.54} = 1.25$ or 125%. Formula 1

Table 3
1.85TH POWER OF NUMBERS
(1.10 to 5.0)

No.	1.10	1.20	1.25	1.30	1.40	1.50	1.60	1.70	1.75
Power	1.19	1.40	1.51	1.62	1.86	2.12	2.37	2.66	2.82
No.	1.80	1.90	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Power	2.97	3.28	3.6	5.45	7.62	10.15	13.0	16.2	19.6

Table 4
0.54TH POWER OF DECIMAL FRACTIONS
(.10 to 1.0)

No.	.10	.20	.25	.30	.40	.50	.60	.70	.75	.80	.90	1.0
Power	.288	.42	.473	.522	.61	.687	.758	.824	.856	.886	.945	1.0

C. To reduce the friction loss 25% and also increase the flow of 25% requires the replacement of:

29.2% to reduce the friction loss and
39.5% to increase the flow

68.7%=total replacement.

Problem 3

Assume the same conditions as in problem 1, except that it is considered more expedient to parallel a portion of the 4″ main with 6″ main.

A. What per cent of the 4″ main should be paralleled with 6″ main to decrease the friction loss 25%?

In this instance, it is necessary to determine the equivalent diameter of the 4″ and 6″ mains.

By formula 4, $De = 0.92\sqrt{(4.12)^2+(6.16)^2}$
$= 0.92\sqrt{54.91}$
$= 6.817''$

Relative friction loss for 4″ and 6.817″ mains is by formula (3),

$$S_2 = {}^1\left[\frac{4.12}{6.817}\right]$$
$$= 1 \times (.604)^{4.87}$$

From table 5, $(.60)^{4.87}=.084$
By interpolation (table 5), $(.604)^{4.87}=.0864$, say .086

Therefore, the friction loss of the equivalent main (6.817″) is 8.6% of that of the 4″ main.

To determine the per cent of 4″ main to be parallel with 6″ main to reduce the friction loss 25%, proceed as in problem 2A.

1.0 — .086 = .914
.25 ÷ .914 = .274 = 27.4% to be paralleled.

B. To determine what per cent should be paralleled to increase the flow 25%, proceed as in problem 2B.

X = 1 ÷ 1.51 = .661
1.0 — .661 = .339
.339 ÷ .914 = .371 = 37.1% to be paralleled.

C. To reduce the friction loss 25% and also increase the flow 25% requires the paralleling of:

27.4% to reduce the friction loss and
37.1% to increase the flow

64.5%=total per cent paralleled.

Problem 4

A customer seeks advice. He can operate two lawn sprinklers at the rear of his property, from the end of his long line of ¾″ pipe, but he desires 50% more flow so that he can operate three sprinklers.

From table 2, a 1″ pipe will furnish 1.89 times or 89% more water, but only 50% more is desired. How much of the ¾″ pipe should be replaced with 1″?

From table 3 $(1.50)^{1.85} = 2.12$.

X = 1.0 ÷ 2.12 = .472
1.0 — .472 = .528

From table 2, the friction loss for 1″ is .31 or 31% of that for ¾″.

1.0 — .31 = .69
.528 ÷ .69 = .765 = 76.5% of the ¾″ to be replaced with 1″ to increase the flow 50%.

Table 5
4.87TH POWER OF DECIMAL FRACTIONS
(.20 to .99)

	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.2	.0004	.0005	.0006	.0008	.001	.0012	.0015	.0017	.002	.0025
.3	.0028	.0034	.004	.0045	.0053	.006	.007	.008	.009	.0103
.4	.0115	.013	.0148	.0165	.0182	.0206	.023	.0256	.028	.031
.5	.0343	.038	.0417	.046	.05	.055	.06	.065	.071	.077
.6	.084	.09	.0975	.106	.115	.1225	.1325	.1425	.154	.165
.7	.176	.188	.20	.216	.231	.247	.2635	.281	.30	.3175
.8	.338	.36	.381	.405	.429	.455	.48	.508	.5375	.5675
.9	.600	.6315	.666	.7025	.74	.7785	.82	.862	.9063	.9523

Cabbages? Heck No! Just Gary Grease Balls

Believe-it-or-not, these piles of what appear to be cabbages are grease balls removed from the aeration tanks at the Gary (Ind.) Sewage Treatment Plant.

For the picture we are indebted to "Bill" Mathews, superintendent of the Sanitary District of Gary, who has the following to say:

"You are looking west along one of our catwalks between the aerators which is seven feet in width. Those are not atomic bombs that you see piled up but grease balls which range all the way in sizes from a golf ball up to a basketball, with the average size being from 4 to 5 inches in diameter.

We have been getting more oil then usual since the first of the year and this has resulted in the formation of these grease balls which do not improve the quality of the final effluent. We have never heard of anyone having such an accumulation as shown in the photograph."

In response to our query—Now that you have 'em, "Bill," how do you get rid of 'em?—here's "Bill's" reply:

"These balls were piled up in a clear sandy area and allowed to dry out for about one week. Then kerosene or gasoline is poured over them and touched off. From the billows of black smoke it looked as if we had an oil refinery fire. There is very little ash left after burning."

Can anybody top this story in the line of "An Operator's Headaches."

WATER WORKS PRACTICES

OPERATION • MAINTENANCE • MANAGEMENT

The Hydrologic Cycle

The Fourth of a Series

by **GEORGE E. SYMONS, *Ph.D., Consultant & Technical Editor, Larchmont, N. Y.***

CONTINUING the practice of answering questions pertinent to previous lectures here is one referring to Lecture No. 2.

Q.—Was the deep well referred to in the Bible, Joseph's well or Jacob's well? This question comes from "student-reader," David J. Purdie, longtime representative of Builders-Providence, Inc., in New York City.

A.—It is the same well. Some persons have referred to it as Joseph's well because it was on his land, but it was "digged" by Jacob who was Joseph's father.

The reference to the well appears in the 4th Chapter of John, where it tells of the meeting of Jesus and the woman of Samaria. Briefly the story is: Jesus left Judea and departed into Galilee and had to go through Samaria, where he came to the city of Sy-char "near to the parcel of ground that Jacob gave to his son Joseph . . . now Jacob's well was there . . . and the well is deep."

In several of the verses in this chapter we see the oft repeated symbolic use of the word water (and well) to mean life, both mortal and spiritual. In fact, although the word well, as a noun, is mentioned 19 times in the Bible, only eight references are to water wells and only four actual wells are referred to. These are the wells at Beer-Sheba ("digged" by Abraham); at Bethlehem (by the gate); at Bahurim (where Alimaaz and Johnathan were hidden in the well), and at Sy-char (Jacob's or Joseph's well).

All of the other uses of the word well are symoblic, referring to the spirit, the source of life, and the belief in God. In one of the Songs of Solomon which begins "Behold, Thou art fair my love," the word is used to describe the desirable attributes of the fair lady, wherein it says she is "a well of living waters."

On the statistical side, Jacob's (or Joseph's) well is said by some to have been 297 ft. deep and to have been of large diameter. According to "Dave" Purdie, the well is still more than 100 ft. deep and travellers still cast stones into it to hear the echo. —I, like reader Purdie, "marvel at the old guy delving so far into the earth."

The Hydrologic Cycle

1. The World of Water

a. Since the beginning of the earth, water has played a vital part in the development of geologic formations and life, both animal and vegetable.

b. The water in today's world is the same that existed millions of years ago, when the oceans were fresh water, and there is neither more nor less of it now than then. Thus, WATER is one natural resource which is inexhaustible.

c. Oceans cover about three-fourths of the globe and would cover the whole earth to a depth of about two miles if the earth's surface were leveled off.

* * * If all the moisture in the atmosphere surrounding the earth were condensed, it would add only about one inch to that two mile depth.

d. The total amount of water is constant but the relative amounts in the oceans, lakes, streams, ground and in the air are in a constant state of change and variation. The oceans remain the great reservoir of all the waters which furnish life on this planet.

2. Unending Cycle

a. A repeating cycle exists whereby water rises, salt free, from the ocean reservoirs to be borne by the winds across the face of the land and to return to the sea through various ways.

b. Source of energy for this cycle is the sun which distills from the ocean brine, pure water vapor to be picked up by the winds.

c. Air as a gas can hold but a limited amount of water vapor. When this "gas" becomes saturated at one temperature, a temperature decrease will cause a condensation of moisture, which falls to earth as rain or snow. That rain, which falls a few miles vertically, at most, may have travelled thousands of miles from where it was "picked up" by the winds.

d. When precipitation hits the earth, it runs off to form surface water which flows to the sea or evaporates to the atmosphere, or percolates into the earth to form ground water, which is stored or moves slowly to the sea or is used by plants from which the water transpires to the atmosphere.

* * * This unending movement of water from the sea back to the sea through these various channels is

This article is one of a series on the general subject of "Water Works Practices." Each article has been developed by Dr. Symons from his notes for a Water Works Short Course and each is presented in the simple style of a short course lecture. The series has been designed to be of interest and aid to small plant operators, new operators, students, and any who may wish to review the fundamentals of water works practices.—The Editors.

called the "Hydrologic Cycle." (See accompanying sketch).

3. Precipitation

a. Major weather paths decide where airborne moisture will be spilled. In the U.S. these paths pass generally from southwest to northeast and some directly from west to east.

* * * Cyclonic storms (not cyclones) resulting from interaction of southward moving polar air masses and the warm moist air masses from the equatorial areas produce most of the rainfall, although local thunder storms likewise contribute heavily to certain areas.

* * * The relative numbers of cyclonic storms per year in the U.S. is shown in relation to regional areas in Table 1. The smaller number generally represents the southern part and the larger number the northern part of each region.

Table 1
CYCLONIC STORMS AND RAINFALL IN THE U. S.[1]

Region	No. of Storms	Av. Rainfall Range Inches
New England	30–45	30–50
Middle Atlantic States	15–30	40–50
Atlantic Coast—South	5–15	40–60
Florida	0–5	50–60
Mid-west—North	20–45	30–40
Mid-west—Central	15–25	30–50
Mid-west—South	5–15	30–60
Northwest	10–15	10–25
Southwest	0–10	0–20
Pacific Coast—North	5–15	40–100
Pacific Coast—South	0–5	10–30

b. Precipitation includes rain, snow, sleet, hail, fog and dew; about 80 per cent is "effective" as rain or snow.—The amount of rainfall in the U.S. averages about 30 inches a year but varies from year to year, from season to season, and from region to region. It is not possible to assign definite averages to specific areas but Table 1 shows the range of "average" rainfall in the various regions. In the column on rainfall, the higher number represents the eastern (not northern) part of the area and the lower number the western (not southern) part, except on the Pacific coast, north, where the heaviest rainfall is near the coast.

* * * About two-thirds of the total U.S. rainfall is in the eastern half of the country and water problems revolve around floods, navigation, erosion and water excess. About one-third of the total is in the western half of the country (except the coast) and problems revolve around drought, dust storms and water shortage.

c. Regional rainfall reflects importance of cyclonic and thunderstorms but local topography and local atmospheric conditions have important bearing on actual precipitation, as for example, the 160 inches a year in the Olympic mountains of the Pacific northwest and the less than 10 inches in Arizona, Nevada and Utah.

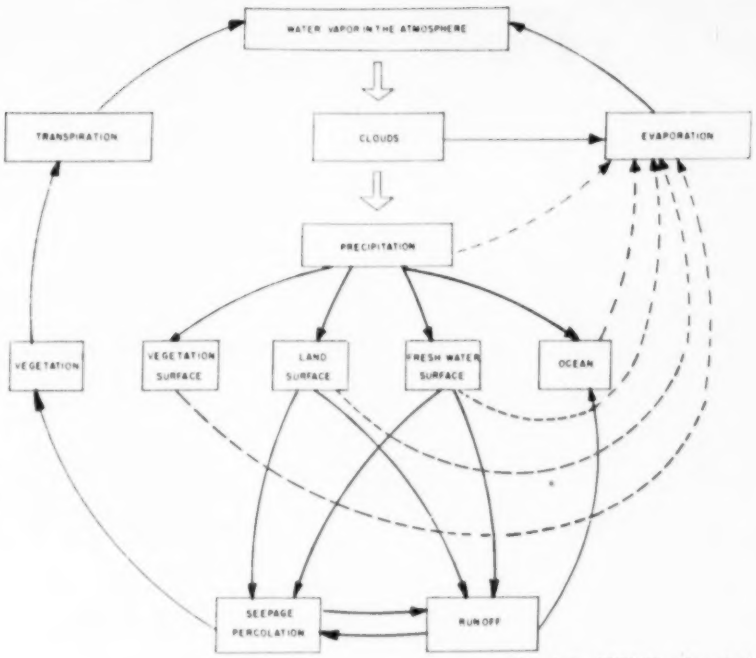
* * * Thunderstorms follow local patterns which often have no relation to cyclonic storms and hence affect local amounts of rainfall. A good example is Florida with few cyclonic storms but rainfall reaching twice the national average.

* * * Individual rainstorms, particularly of the "cloud burst" type may greatly affect small areas as to total rainfall in any year. While longtime averages are represented in Table 1, individual years may show variations from the norm of plus or minus 20 inches and individual longtime monthly averages may vary as widely percentagewise.

d. Rainmaking in arid areas dates to century old practices of the Aborigines. Modern attempts at rainmaking dates from the 1920's. In Texas exploding shells and balloons were used and were reported to have produced a few drops; in 1926 an electrical discharge at Los Angeles produced a light drizzle; in 1931 the Russians sent up smoke screens and produced eight minutes of rainfall.

* * * Scientific rainmaking has developed within the decade, beginning with experimental cloud seeding from aeroplanes with dry ice, and later silver iodide particles. Cloud seeding is still practiced, but in western states where rainmaking is now big business, ground generators are used. These burn coke impregnated with silver iodide, some 30 quadrillion particles per minute being discharged into the air.

* * * Rainmaking techniques do produce rain, but pro and con arguments still exist over whether the total rainfall for the region is increased or whether the rainfall is merely made to occur in one place instead of another. Legal problems range from damage by unwanted rain to deprivation of rain in areas which have expected it naturally.



(Courtesy POWER Magazine)

THE HYDROLOGIC CYCLE.

4. Runoff

a. Of the total amount of water precipitated on land areas approximately 20 per cent runs off the surface to ponds, lakes and rivers in an effort to seek a lower level and eventually the sea.

b. The rate of runoff and amount depends on the ground cover, the season and the porosity of the earth. Where ground cover is thick, rate of runoff is relatively slow; in denuded areas, relatively fast. Where ground cover is heavy or where the soil is porous, the amount of runoff is reduced. Snow, of course, is slow to run off except during spring thaws when rate of runoff may be rapid since ground covering is less and frozen ground prevents seepage.

(1) Adapted from *Power* Magazine, Sept. 1952.

Table 2
RAINFALL EVAPORATION IN U. S.[2]

Region	Transpiration Evaporation & Inches per Year
New England	10-30
Middle Atlantic States	20-40
Atlantic Coast—South	40-50
Florida	40-50
Mid-west—North	20-40
Mid-west—Central	40-60
Mid-west—South	40-60
Northwest	50-60
Southwest	50-100
Pacific Coast—North	20-50
Pacific Coast—South	30-70

5. Surface Water

Surface water results from runoff, except relatively small amounts which fall directly on the bodies of water. It is this runoff which constitutes the source of supply of about 80 per cent of the water used in the U.S.

6. Evaporation and Transpiration

a. Evaporation is the return of moisture to the air directly from ground or water surface; it is a distillation process energized by heat from the sun.

b. Transpiration is the sending off to the atmosphere water vapor from the surface of vegetation, particularly leaves.

c. About 72 per cent of the rainfall in the U.S. rises again to the atmosphere through evaporation and transpiration. Less than half or about 30 per cent is direct evaporation from ground and water surfaces.

d. Rate of evaporation and transpiration depends on temperature, vapor pressure in the atmosphere, wind movement and topography. Approximate annual evaporation and transpiration rates are shown in Table 2.

In Table 2 the lower value generally represents the northern part and the higher figure the southern part of each region. These figures include both evaporation and transpiration.

e. Amounts of transpiration have been related to temperature as shown in Table 3, adapted from Meyer's basic curve first published in 1915 and confirmed in 1952 by long-term observations [3] of citrus fruit trees.

* * * Older trees transpire more water than younger trees, by about 20 per cent, and good trees transpire about 20 per cent more water than fair trees.

* * * Other vegetation, too, requires much water; a single stalk of corn requires 440 pounds (54 gal) of water for its growth and transpiration; an acre of spruce forest transpires 8.5 inches a year; and an acre of lush grass will lift more than six tons (about 1440 gal) of water on a June day.

Table 3
TRANSPIRATION VERSUS TEMPERATURE[3]

Mean Monthly Temperature—Deg. F.	Transpiration—Inches per Month (Mar. to July)	(Aug. to Nov.)
40	0	
45	0.5	0
50	1.0	0.6
60	1.8	1.3
70	2.4	2.2
80	3.3	3.2
85	3.8	3.8

7. Percolation and Ground Water

a. About half of the total rainfall percolates, infiltrates or seeps into the ground, from which it is drawn, used and transpired by vegetation or works its way into porous strata.

b. Roughly four-fifths of the water entering the ground (or about 40 per cent of the total rainfall) leaves the ground by transpiration through plants. Only about eight to ten per cent of the annual rainfall goes into underground storage.

c. Ground water moves at an extremely slow pace, always downhill toward the sea; it may come to the surface or discharge into a lake, river or the ocean, or it may end blocked in some underground storage.

8. Summary

a. The Hydrologic Cycle supplies the unending chain of water from the oceans to the air, to the earth, to living matter, to the oceans again.

b. In the course of the cycle, man makes use of this water obtaining his needs from water on the surface of the earth or water below the ground level, that is, from either of two sources of supply.

c. Recommended for collateral reading on the subject, a "Special Editorial Report on Water," published by *Power*, in Sept., 1952.

Next Lecture—SOURCE OF SUPPLY

(2) Adapted from *Power* Magazine, Sept. 1952.

(3) Meyer, A. F., "Water Use by Growing Trees." *Water & Sewage Works, 99*, p R-65 (Apr. 1952)

Fluoridation Safety Established "Beyond Any Reasonable Doubt"

The safety and effectiveness of fluoridation of public water supplies has been established beyond any reasonable doubt, two scientific bodies have reported in the May 1953 Journal of the American Dental Association.

The Association's Council on Dental Research, made up of leading dental scientists, reiterated "its confidence in the validity of the scientific investigation of the fluoridation of public water supplies" after re-evaluating evidence on the measure.

The council emphasized three points: (1) that "millions of people have consumed drinking water incidentally containing one part per million or more of fluorine for generations without known deleterious effect;" (2) that investigations leading to development of the program are scientifically sound, and (3) that "continuous study by qualified investigators has emphasized the safety" of the procedure.

At the same time, the Association's Council on Dental Health found that "a voluminous amount of scientific data accumulated over a long period has established beyond reasonable doubt the safety and efficacy" of the measure.

In an editorial, The Journal cited two new scientific studies which "strengthen the already sound position of proponents of water fluoridation."

One study, made by three research scientists at the University of Rochester, was concerned with fluorides and bone structure and showed that drinking water containing one part per million fluorine could not have a harmful effect on bone tissue, even if all the fluorides in water consumed throughout a lifetime were stored in the bones.

The report was made at recent annual meeting of Federation of Societies for Experimental Biology by Drs. Frank A. Smith, Dwight E. Gardner and Harold C. Hodge.

In the second study, a Yale University School of Medicine scientist studied the relation of cancer to fluorides and reported that tumors transplanted into mice developed more slowly if the mice received fluorides. The study was made by Dr. Harold S. Fleming and presented at the recent annual meeting of the International Association for Dental Research.

"The scientific evidence mounts monthly in favor of fluoridation, The Journal said, "leaving to opponents of the process only vapid arguments based either on emotionalism or misinformation."

1953 Conference of A.W.W.A. in Grand Rapids, Mich.

First Report—Highlights of the Meeting and of Some Technical Sessions

IMPRESSIVE indeed are statistics relating to the 1953 meeting of the American Water Works Association in Grand Rapids, Mich., May 10-15, 1953. In spite of predictions of a much lower attendance, registration reached 1,897 at this—the 73rd—annual conference of the association (registration was higher by only 99 at Kansas City in 1952).

There were 87 exhibitors occupying 144 booths, compared with 87 and 145 last year, and several exhibitors claimed their exhibits drew more attention than ever before. The Water and Sewage Works Manufacturers Assn. reported 4,056 bottles of "coke," as compared with 3,208, were dispensed with the compliments of that association—attendance in the exhibit area *must* have improved!

An interesting analysis of registration (ladies excluded) has also been supplied by the W. & S.W. Mfrs. Assn. for the 1952 and 1953 conventions. Among those registering during the first three days there were:

	1952	1953
Manufacturers	686	653
Operators	391	371
Engineers (Consultant, Sanitary, Water Works)	266	206
City Managers & Officials, Chemists, Professors, Utility & Water Commissioners, Dept. of Health Officials, etc.	120	196

More Statistics

The program reveals that the four divisions of the A.W.W.A., separately and jointly, held 14 technical sessions. There were 85 speakers listed in the directory—and, of course, many discussors from the floor. One afternoon session was devoted to technical motion pictures. Official and committee meetings listed in the program totaled 23.

The inspection trips, by bus, delivered many members to the Grand Rapids Filtration and Pumping Plants. The filter plant was originally constructed in 1912 and was enlarged in 1921. The raw water is now supplied from Lake Michigan through a 30-mile forty-six-inch pipe line. Alum, lime, and chlorine are used for coagulation and disinfection. This city pioneered in public water supply fluoridation, starting treatment January 25, 1945. Plant capacity is 44 mgd.

The Social Events

Equally important, of course, was the lighter side of the meeting. The Michigan Section members deserve high praise for an outstanding accomplishment in this part of the conference.

The mere listing of events will bring pleasant recollections to all who attended: there was the Dutch Buffet; then Meet and Greet night; an eveing devoted to presentation of awards and to the President's Reception and Officer's Ball; there was Paul Bunyan night; and, finally, "Klompen Time" was an evening of Dutch entertainers, dancers, and wooden shoe makers. Ending it all was the Association's annual dinner and Inaugural Ball.

The list of events provided especially for the ladies is nearly as long: Style Show and Tea; Luncheon and Book Review; Hats with Personality (this we do not propose to explain); and a trip by cars and bus to the Tulip Festival in Holland, Mich. (this we can understand and wish we might have taken).

What else? Well, a golf tournament at Blythefield Country Club; and the Fuller Award Society Breakfast; and the Manufacturer's Association Luncheon with Willard F. Rockwell, Asst. Secy. of Defense, as guest speaker.

Most important, perhaps, there was opportunity to visit with friends and make new acquaintances, to discuss mutual problems and how to solve them. That opportunity is always a significant contribution of such technical meetings.

Next year Seattle, Washington, will be host to the 74th Conference. It is something to plan for, as the excellent convention facilities and the

Outgoing President
Charles H. Capen
Chief Engr.
Jersey Water Comm.
Wanaque, N. J.

Association Officers

Incoming President
M. B. Cunningham
Supt. & Engr.
Water Dept.
Oklahoma City, Okla.

Vice President
Dale C. Maffitt
Gen. Mgr.
Water Works
Des Moines, Ia.

Honorary Membership
Wendell R. La Due
Chief Engr. & Supt.
Water & Sewage
Akron, Ohio

Reeves Newsom
Village Mgr.
Scarsdale, N.Y.

Diven Medal
James E. Kerslake
Supt. of Filt.
Water Purif. Plant
Milwaukee, Wisc.

Goodell Prize
Edward W. Moore
Assoc. Prof.
Harvard Univ.
Cambridge, Mass.

INSPECTION TRIP—Grand Rapids water plant

Views of the plant constructed in 1912 and enlarged in 1921 to its present capacity of 44 mgd. Outside, members inspect settling basins. Inside, they study pioneer equipment for feeding sodium fluoride.

enthusiastic planners promise an outstanding meeting.

Honors and Awards

The presentation of 1953 Awards took place on the evening of Monday, May 11.

Honorary Membership was conferred upon two members in recognition of their exceptional service to the Association and of their professional standing:

WENDELL R. LA DUE, Chief Engineer and Superintendent, Bureau of Water and Sewerage, Akron, Ohio, and
REEVES NEWSOM, Village Manager, Scarsdale, N.Y.

The *Diven Memorial Medal*, "in recognition of his outstanding contributions to water purification progress . . . ," was awarded to:

JAMES EARL KERSLAKE, Superintendent of Filtration, Water Purification Plant, Milwaukee, Wisc.

The *Goodell Prize*, for his paper published in the A.W.W.A. Journal, March 1952, entitled "The Precision of Microscopic Counts of Plankton in Water," was awarded to:

EDWARD WARREN MOORE, Associate Professor of Sanitary Chemistry, Harvard University, Cambridge, Mass.

Fuller Award recipients were named by twenty-eight of the Association's sections. Those receiving the 1953 Awards, and the sections of which they are members:

Harold Winans Yost, *Arizona*
John Stalker Longwell, *California*
Oswald Hayward Scott, *Canadian*
Edward Bredell Showell, *Chesapeake*
Lawrence Handy Daniel, *Cuban*
Harry Thomas Oberly, *Florida*
Arthur Moses Buswell, *Illinois*
Howard Scott Morse, *Indiana*
John Robertson Barnes (deceased), *Iowa*
Major Callaway Hagar, *Kansas*
John Wiley Finney, Jr., *Ky.-Tennessee*
John Frederick Dye, *Michigan*
Alexander Charles Janzig, *Minnesota*
Roger Chase Higgins, *Missouri*
Francis Frederick Palmer, *Montana*
Harry Lane Morris, *Nebraska*
Warren Joseph Scott, *New England*
George Frederick Wieghardt, *New Jersey*
Harry Edward Jordan, *New York*
Harold Franklin Davis, *North Carolina*
Earl L. Coleman, *Ohio*
John Wilbur Cunningham, *Pacific N.W.*
Harry Mortimer Freeburn, *Pennsylvania*
Adolph Delinus Mars, Jr., *Rocky Mt.*
John Liddell Hawkins, *Southeastern*
Robert O. Gresham, *Southwest*
Michael John Siebert, *Virginia*
Lawson Haynes, *West Virginia*

Section Awards

A.W.W.A. Section Awards were presented at the annual dinner, Thursday evening, May 14.

The NEBRASKA SECTION was awarded the *Nicholas S. Hill Jr. Cup.*

Association Secretaries

Secretary	Exec. Asst. Secy.
Harry E. Jordan	Raymond J. Faust
(Head the New York office of the A.W.W.A.)	

The CUBAN SECTION was awarded the *Franklin Henshaw Cup.*

The CALIFORNIA SECTION was again the winner of the *Old Oaken Bucket.*

New Directors

Taking office at the close of the annual meeting, to serve until 1956, are eleven new directors from the A.W.W.A. Sections named:

Tip H. Allen, *Alabama-Miss.*
R. Gail Baker, *Arizona*
John W. Pray, *Iowa*
Charles H. Bagwell, *Kentucky-Tenn.*
Louis E. Ayres, *Michigan*
Ralph H. Lancaster, *Nebraska*
Fred P. Stradling, *New England*
George D. Norcom, *New Jersey*
James C. Harding, *New York*
Charles C. Casad, *Pacific N.W.*
L. S. Morgan, *Pennsylvania*

New Division Officers

Officers elected to serve the four Divisions of the association for the coming year are:

WATER WORKS MANAGEMENT DIVISION
Chairman, W. A. Glass
Director, Water and Sewer Dept.
Miami, Fla.
Vice-Chairman, N.S. Bubbis
Gen. Mgr., Water & Sanitation District
Winnipeg, Man.
Secretary, F. C. Amsbary
V.P. and Cecy., Illinois Water Service Co.
Champaign, Ill.

WATER RESOURCES DIVISION
Chairman, Fred Merryfield
Prof. of C.E., Oregon State College
Corvallis, Ore.
Vice-Chairman, C. H. Bechert
Dir., Water Rec. Div., Conservation Dept.
Indianapolis, Ind.
Secretary, B. S. Grant
Ch. Engr. & Asst. Mgr., Water & Power Dept.
Los Angeles, Calif.

WATER PURIFICATION DIVISION
Chairman, W. W. Aultman
Asst. Dir., Water & Sewage Dept.
Miami, Fla.
Vice-Chairman, William Yegen
Supt., Filtration Plant
Bismarck, N.D.
Secretary, H. C. Medbery
Water Purif. Eng., Water Dept.
San Francisco, Calif.

TRANSMISSION AND DISTRIBUTION DIVISION
Chairman, E. A. Schmitt
Head Engr. & Chief, Washington Aqueduct
Washington, D.C.
Vice-Chairman, M. K. Socha
Head, Water Works & Supply Div.
Los Angeles, Calif.
Secretary, F. E. Dolson
Distr. Engr., St. Louis County Water Co.
University City, Mo.

Water Purification Division Technical Sessions

At the first technical session of the Water Purification Division, the pre-

MEN at work—and LADIES at play

(1) The *Water & Sewage Works* booth—one of 87 exhibitors. (2) Committee meeting of Water Purification Division officers. (3) Ladies ready to leave on bus trip to the Tulip Festival in Holland, Mich.

PAUL Bunyan Night

(1) Home folks—Mrs. Ray Faust and the Exec. Asst. A.W.W.A. Secy. (2) Michigan and Montana meet—Les Harris and Mrs. Harris of Grand Rapids, with John Hazen of Butte, Mont. (3) Prexy and Mrs. Capen are served "blue snow" by barmaids Dorothy Dimmers and Lois Jordan. (4) Michigan members tell Paul Bunyan stories. (5) The singing bartenders.

siding officers were R. L. DERBY, Chairman; D. L. MAFFITT, Co-Chairman; and J. F. DYE, Associate.

Using Activated Silica

"ACTIVATION OF SILICA" was the title of a paper presented by Charles A. Black, President, Black Labs., Inc., Gainesville, Fla.

Mr. Black reviewed the background of silica activation and then discussed modern trends in the application of this growing water treatment process. He noted that some 150 years ago the descriptive terms "sol," "gel," and "peptization" had been proposed. It was only seventeen years ago, however, that Baylis (at Chicago) and Graf and Schworm (at St. Louis) had carried out independent research and demonstrated the utility of activated silica as a coagulant aid in water treatment.

The Baylis process employs sulfuric acid to partially neutralize the alkalinity of sodium silicate solution, and an aging period of about two hours, for preparation of an effective activated silica. The Graf and Schworm procedure depends upon the mixing of dilute solutions of filter alum and of sodium silicate—and application of the mixture without an aging period.

More recently, Hay described additional methods of preparation based on the use of ammonium sulfate, or a metallic salt, or an acid gas. He also reported in detail upon the control of aging time to effect the most desirable gel formation.

Mr. Black noted the use at Miami of carbon dioxide (Diesel engine exhaust gas) as the activating agent in a batch process for preparing activated silica. A dose of about 20 ppm SiO_2 is used in the treatment of this 30 mgd supply.

Of most present interest is an activation method employing gaseous chlorine. Chlorine reacts with sodium silicate solution to form sodium hypochlorite; the cost of chlorine as an acidifying agent is negligible, however, since it remains fully available as a disinfecting agent.

ARTIST and mural

Authentic pastel paintings of wild life known to Paul Bunyan, decorated the auditorium; artist Doug Feben will donate the collection to the Detroit Public Library. Placard under the mural shown reads:

MOSKITTOS

(Apoideaculexus bibayonettus)

The naturalist in Paul Bunyan's camp classified these as birds. They were so big they could straddle the stream and pick the passing lumberjacks off the log drive. Sometimes a logging crew would find one in this position, quickly tie his legs to convenient trees and use him for a bridge across the river. Paul imported from a Texas a drove of fighting bumble bees to combat the mosquitos. They fought for a while, then made peace and intermarried. The result of this crossing made the situation worse than ever for the loggers. The offspring had stingers at both ends.

Activated silica, as a coagulant aid (or as *the* coagulant) is becoming the standard treatment for lime-softened water in Florida plants. It often results in a saving of alum, expands the capacity of treatment plants, and generally decreases the silica content present in the raw water; dosages range from 2 to 15 ppm. Jar tests are particularly important to determine the proper point of application in each plant. A wider variety of promising applications was predicted for the future—with greater emphasis on continuous rather than batch methods of preparation.

A. E. GRIFFIN, Technical Service Div., Wallace & Tiernan Co., Inc., Newark, N. J., presented a discussion of Mr. Black's paper.

Mr. Griffin described the activation process as involving release of the SiO_2 portion from sodium silicate, or controlled formation of a "micelle." The micelle was defined as a structure larger than molecular but still submicroscopic in size. He commented at some length on importance of controlling the aging process to stop at just the proper point (this can be done by adding water). Experience has shown that if complete gelation is allowed to occur, activated silica can completely close the surface of a sand filter.

Mr. Griffin reported that in the chlorine method of preparing activated silica it has been found unnecessary to hold closely to a specific per cent of aging time. (This is of particular importance in the application of a continuous rather than a batch process.) A simple test was described as the most satisfactory test of total time required for gel formation: the end point is reached when the activated silica solution clings like glue to a tilted glass container—no determination of pH value or chlorine content is required.

KLOMPEN time

(1) Dutch entertainers from the Netherlands and (2) Klompen dance troupe from Holland, Mich. (3) Craftsman demonstrates how "easy" it is to carve a chunk of poplar wood into a wooden shoe.

Storage of Liquid Chlorine at Water Plants?

"STATIONARY STORAGE OF LIQUID CHLORINE" was the subject of a paper

Fuller Awards

M. J. Siebert, Sales Repr., Neptune Meter Co., Richmond, Va.
R. O. Gresham, Editor, So. West W.W. Jour., Temple, Texas
H. S. Moorse, President, Indpls. Water Co., Indianapolis, Ind.
W. J. Scott, Dir., San. Engrg., State Health Dept., Hartford, Conn.

prepared by A. S. Woodard, Ch. Engr., Central Engineering Dept., Pennsylvania Salt Mfg. Co., Philadelphia, Pa., and L. L. Hedgepeth, Technical Consultant, Calco Chem. Div., Am. Cyanamid Co., Bound Brook, N. J. Mr. Woodard presented the paper.

The authors noted that, up to the present, the chlorine industry has recommended against stationary storage of liquid chlorine at water and sewage treatment plants. Late in 1950, a joint committee of the A.W.W.A. and of the F.S. & I.W.A. was organized to report on action to insure an adequate supply of chlorine for water and sewage uses; subsequently a public health advisory committee of the Chlorine Institute was formed with the same purpose in mind. Stationary storage was suggested as one solution and the authors consider this method to be practical and feasible under the proper conditions.

The paper outlined essential principles which apply, discussing the characteristics of chlorine in some detail. Pressure vessels suitable for the purpose must meet national and local requirements (the largest industry single unit car is for shipment of 55 tons of liquid chlorine); the basic tank, fittings, and safety devices—including insulation—meeting I.C.C. regulations, would probably be acceptable for stationary storage units. Considerable data was presented relating to specifications for acceptable pipe lines, valves, and safety valves.

Storage capacity would be determined by the size of the chlorine shipping unit (16, 30 or 55 ton tank cars), by the shipping time, and by the users' needs. The storage tanks should be provided *in duplicate*. The authors noted many specific items required to make stationary storage tanks safe and satisfactory in operation. A remote location was recommended, as even more extreme precautions will be required if chlorine is stored near occupied areas. The potential hazards involved warrant careful study of all problems.

J. E. KERSLAKE, Supt. of Filtration, Milwaukee, Wisc., asked for information as to the cost of stationary storage units. Mr. Woodard replied that the price of a tank mounted on a scale would cost in the vicinity of $15,000. A duplicate installation, including all fittings, safety devices, etc., would apparently require the investment of about $50,000.

About the Microstrainer

"APPLICATION OF THE MICROSTRAINER TO WATER TREATMENT IN GREAT BRITAIN" was described in a paper presented by Richard Hazen, Partner, Hazen and Sawyer, New York, N.Y. There were three programmed discussors.

Mr. Hazen reviewed data based on literature and correspondence, describing himself as—at present—neither an opponent nor proponent of this relatively new device. Over the past hundred years the slow sand filter has been the workhorse of water treatment in England (installed capacity being about 108 mgd, in U.S. gallons). Algae removal problems have been especially acute in river waters largely free from turbidity but rich in organic food material.

The microstrainer was described as a rotary drum filter using fine stainless steel mesh as the straining material. Water flow is from inside the drum and outward through the screen; the screened material being removed by continuous backwashing. Screening was reported to have 74,000 openings per sq. in., with internal area

Fuller Awards

J. F. Dye, Chief Operator, Water Cond. Plant, Lansing, Mich.
E. B. Showell, Water & Waste Sup., E. I. duPont & Co., Wilmington, Del.
R. C. Higgins, Chemist in Chg., Filter Plant, Hannibal, Mo.
A. D. Mars, Dist. Mgr., Neptune Meter Co., Denver, Colo.

Committee Chairmen

Program
Richard Hazen, Partner, Hazen & Sawyer, New York, N.Y.

Transportation
E. A. Sigworth, Indus. Chem. Sales Div., W.Va. Pulp & Paper Co., New York, N.Y.

Local Arrangements
Earl E. Norman, Manager, Light & Water Utilities, Kalamazoo, Mich.
Douglas Feben, Asst. Supt., Filtration Plant, Detroit, Mich.

Host Committee
H. H. Caswell, Manager, Water Dept., Ann Arbor, Mich.
G. J. Hazey, Chief Operator, Filtration Plant, Wyandotte, Mich.

of the opening 0.035 mm. The operating rate, depending on water quality, is 4 to 15 gal. per sq. ft. per min. Head loss is 12 to 18 in. through the entire plant. In England, 260 mgd Imp. is reported to be the microstrainer capacity installed or under construction.

Limited operating data was reported from the London, Kempton Park Plant, and from the Bristol Water Works Co. Barrow Works. Generally, there is little effect on the chemical composition of the water, and turbidity changes only slightly upon microstraining unless the algae concentration is large. Air binding was an early difficulty with these units. Clogging by calcium carbonate occurs and may be corrected by acid cleaning. The installation costs for microstrainers appear to be lower than for sand prefilters, and the operating costs are also lower. In the U.S. the largest potential application would appear to be in waters of New England where algae problems exist, but where coagulation is not required.

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Phila. Sub. Water Co.
Wynnewood, Pa.

F. F. Palmer
City Engr.
Forsyth, Mont.

O. H. Scott
Gen. Mgr
Utilities Comm
Belleville, Ont.

J. L. Hawkins
Superintendent
Water Works
Greenville, S. C.

Fuller Awards

M. C. Hagar
Mfrs. Repr.
Sterling, Kan.

H. T. Oberly
Superintendent
Div. of Water
St. Petersburg, Fla.

A. M. Buswell
Chief
State Water Survey
Urbana, Ill.

J. S. Longwell
Cons. Engr.
Oakland, Calif.

Fuller Awards

P. L. Boucher, Glenfield & Kennedy, Ltd., Civil Engrs., London, England, a programmed discussor of the paper, reported microstrainer capacity installed or under construction in Great Britain to be nearly 400 mgd (in U.S. gals.).

A wide range of wire mesh fabrics now in use extends to a fineness of 135,000 per sq. in. The finer screen size may make it possible to use microstrainers with coagulated water—especially where activated silica is employed as a coagulant aid.

Mr. Boucher described details of several installations, and gave comparative cost data. In addition to their application as prefilters, these microstrainers may find use as: primary filters ahead of rapid sand filters; as a treatment process in conjunction with chlorination; for polishing of sewage works effluent; and for treatment of industrial water supplies, influent and effluent.

A. A. Kalinske, Director of Development, Infilco Inc., Tucson, Ariz., the second discussor of Mr. Hazen's paper, also commented on the special uses noted by Mr. Boucher. He described various experimental studies with pilot plant units for water treatment, and reported on one now in operation at the Baltimore sewage treatment plant.

The first U.S. studies were made at the South Side Filtration plant in Chicago, investigating the straining of Lake Michigan water for a 13 month period. Results based on daily plankton counts show the highest percentage reductions to be accomplished (average 85 per cent) during the months of most serious plankton loads; lower removals resulted when plankton counts were less serious.

At a paper mill installation, using Lake Winnebago water, suspended solids (originally 25 ppm) were reduced to 5 to 10 ppm. At the Baltimore sewage plant, the final clarifier effluent shows about 50 per cent of suspended solids and of B.O.D. can be removed by microstraining. Since most U.S. waters are turbid or colored, this device appears to be of limited general application.

Arthur W. Consoer, Chief Exec. Partner, Consoer, Townsend & Assoc., Chicago, Ill., presented the final discussion. He described the potentialities of the microstrainer as of much interest to various Lake Michigan plants where short filter runs are experienced.

He noted that large storage capacity might work well in conjunction with microstraining. Present data is inadequate, and designing engineers must do more cooperative work with

Golf
J. Leslie Hart
Western Sales Mgr.
U.S. Pipe & Foundry
Chicago, Ill.

Meet and Greet
W. Leslie Harris
Supervisor
Water Plant
Grand Rapids, Mich.

Local
O. E. Eckert
Gen. Mgr.
Water & Elec. Commrs.
Lansing, Mich.

Klompen Time
Paul Stegeman
Superintendent
Water & Sewage Depts.
Midland, Mich.

More Committee Chairmen

Paul Bunyan Night
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New Directors

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J. W. Pray
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Fort Dodge, Iowa

plant operators before substantial conclusions can be reached.

Water Works Progress Reports

At the second technical session of the Water Purification Division, presiding officers were R. L. DERBY, Chairman; W. W. AULTMAN, Co-Chairman; and J. C. RICHARDSON, Associate. This session included one technical paper and a number of Division committee reports.

Progress Report on Silver

"A REEXAMINATION OF OLIGODYNAMIC DISINFECTION" was the title of a paper presented by Dr. Charles Renn, Dept. of San. Eng. and Water Resources, Johns Hopkins Univ., Baltimore, Md.

This paper was a progress report on a study of material presently manufactured in Switzerland and used in Europe for water supply disinfection. It is produced by forming ultra-thin films of silver and mixed silver oxides upon activated carbon or similarly porous surfaces, and is a contact material known as "Hyla 603K."

The process is described as differing from other oligo types of sterilizing systems in the balance obtained by combining the two different phases: first, very minute concentrations of active silver (in the order of less than 10 parts per billion) which maintain residual disinfecting action in the effluent; and second, a significant degree of disinfection obtained during the interval of contact within the bed substrate that develops the continuing residual action.

While early reports by others raised hopes that the Hyla material might be used to disinfect emergency water supplies, this study has already demonstrated that the material will not kill or inactivate water-borne cysts of pathogenic amoeba. The studies establish, however, that the Hyla contact bed has a highly bacteriostatic effect and leaves a slower acting true residual agent.

Turbid waters must be prefiltered; low temperatures retard aligodynamic action, as do high concentrations of chloride, sulfate and sulfide ions; high concentrations of organic matter may reduce the efficiency of the material—these are important limitations. There is evidence that the contact system is an oxidizing medium and that dissolved oxygen is involved. This oxidation process is of much interest, and may serve to indicate the functioning rate of an oligodynamic system. Studies of suitable oxidation indicators are now being made.

Report on Open Reservoirs

ELWOOD L. BEAN, Chairman (Prin. Asst. Engr., Bureau of Water, Philadelphia, Pa.), presented the report of Committee E5.7 on "Open Air Reservoirs." This is the final report of that committee, formed in 1946 under N. J. Howard, chairman, who presented five progress reports before resigning.

The scope of the committee relates to "all reservoirs to which there is conveyed for storage—short or long—water of quality considered suitable for direct discharge to a potable water distribution system." This committee concludes that the use of all open air reservoirs need not be prohibited. It recommends:

(a) The covering of all reservoirs constructed in the future which come within the scope quoted above.

(b) The serious consideration of the following possibilities, in order of preference:

1. Covering such reservoirs in the "not too distant future."
2. Providing automatic disinfection of all water drawn from any operating reservoir—unless ample residual of a disinfecting agent is at all times carried through the reservoir to the distribution system.

Reports on Waste Disposal

JOHN B. DEAN, (Div. Engr., Supply & Purif. Sec., Water Div., St. Louis, Mo.), a member of Committee E5.8, presented a report.

During the past year, members of this committee have devoted attention to study of wastes from coagulating basins operated primarily for clarification. The conclusions presented in this report:

Plants located on large rivers or lakes where reasonable dilution is possible will probably be permitted to discharge wastes into them indefinitely. In new plants, the bottoms of basins and drains from them should be high enough to drain to streams or sludge beds at high river stages.

Where purification wastes are discharged to the raw water stream, the number of bacteria returned with wastes is very much lower than the number withdrawn in the raw water. When the discharge of water purifica-

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tion wastes into a stream or lake is prohibited, they can be impounded and the clear supernatant water drawn off; usually means for sludge removal will be necessary.

WILLIAM W. AULTMAN, Chairman (Asst. Dir., Dept. of Water & Sewers, Miami, Fla.), Committee E5.8, explained that this committee on "Disposal of Wastes from Water Purification and Softening Plants" made its first report in 1947 on three phases:

1. Filtration plants and coagulating basins.
2. Ion exchange and softening plants.
3. Lime and lime-soda softening plants.

Reports published (or to be published) in the Association Journal are:

Three papers: on the disposal of sludge from lime and lime-soda softening, of brine from sodium zeolite softeners, and of filter wash water (issue of December 1947).

Two papers: on lime and lime-soda sludge, and brine from cation exchange softeners (issue of September 1949).

One paper: on wastes from coagulating basins—the preceeding Dean report (to be published).

The committee considers only one phase remains to be covered—the disposal of wastes containing radioactive substances, which constitutes a specialized study; and, having completed its reports, the committee asks to be discharged.

Report on Fluoridation

O. J. MUEGGE (State San. Engr., Madison, Wisc.), Chairman of Committee E5.10, being ill, his report was prepared by R. S. PHILLIPS (Environmental Health Lab., Army Chem. Center, Md.) and presented by R. W. OCKERSHAUSEN (Tech. Service, Gen. Chem. Div., A. C. & D. Corp., Edgewater, N. J.) This committee is set up by the A.W.W.A. to report on "Fluoridation Materials and Methods."

The latest data (U.S. P.H.S. estimate) show that in the U.S. as of May 1, 1953:

769 communities are receiving fluoridated water.

14.3 million is the population of these communities.

15.8 is the population of additional communities which have approved but not yet started similar treatment.

The growth in the practice of fluoridation has been as follows:

Year	Number of Water Systems	Number of Communities
1945	3	3
1946	9	9
1947	11	11
1948	13	18
1949	27	33
1950	62	78
1951	172	240
1952	354	447

With reference to equipment, it was pointed out that 184 new plants during 1952 selected dry feed application, and more than half of these are to apply sodium fluosilicate.

Reports on Revision of Water Manual

Progress reports were presented by two committees working on revisions of the A.W.W.A. Manual of Water Quality and Treatment.

R. L. MCNAMEE, Chairman (Drury, McNamee & Porter, Ann Arbor, Mich.), Committee E5.B3, Chapter on Filtration, noted that work was started in 1952. Twelve sections of the chapter have now been revised or are in process of revision.

GUY R. SCOTT, Chairman (Engr., Black & Veatch, Kansas City, Mo.), Committee E5.B1, Chapter on Aeration, reported on the returns of questionnaires sent to determine data on aerators (spray, cascade, tray, diffused air, and other types). Only 37 replies were received to 77 requests.

It appears that few plants actually make tests to measure the performance efficiency of aeration devices. This committee will endeavor to describe objectively the place aeration should be accorded in modern water treatment plants. Some plants equipped for aeration of surface water have abandoned use of the equipment because taste and odor increase appears to be caused by the growth of algae on the aerators. In plants treating well waters, aeration equipment is not being used because corrosion difficulties in the distribution system are eliminated when the dissolved oxygen content of the finished water is kept at a low level.

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Vice Pres. & Secy.
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Champaign, Ill.

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University City, Mo.

Division Secretaries

Aspects of Water Quality

At the third technical session of the Water Purification Division, the presiding officers were H. C. MEDBERY, Chairman; C. H. CAPEN, Co-Chair-

Charles Renn
Dept. of San. Eng.
Johns Hopkins Univ.
Baltimore, Md.

O. J. Muegge
State San. Engr.
Board of Health
Madison, Wis.

Purification Division Programmers

E. L. Bean
Prin. Asst. Engr.
Bureau of Water
Philadelphia, Pa.

Guy R. Scott
Engineer
Black & Veatch
Kansas City, Mo.

man; and W. L. Harris, Associate.*

Bacteriological Tests and Water Quality

"Do We Need a New Water Quality Yardstick?" Dr. W. L. Mallmann, Dept. of Bacteriology and Public Health, Michigan State College, East Lansing, Mich., answered this question in the negative. He pointed out that the question of establishing new criteria for water quality arises periodically and stimulates water works personnel to examine old standards in the light of new evidence. It was re-emphasized that the presence of *E. coli* is the indicator of pollution arising from fecal origin and that *A. aerogenes* indicates non-fecal pollution. The fact that present water quality standards recognizes both organisms and provides for their differentiation makes it possible to eliminate typhoid fever and enteric diseases when the present standards of quality are attained.

Dr. Mallmann pointed out that present standards are quite readily attainable, and that "no hardship is imposed on operation" in order to meet them. The numbers of false positive bacteriological samples has decreased markedly in water systems where the practice of free residual chlorination has been adopted. A need does exist, however, to improve the laboratory media and testing procedures, since false positives occur even in lauryl tryptose broth.

The occurrence of the coliform group in unpolluted water indicates further that some other "indicator" may be needed for water quality testing. Temperature conditions affect the coliform index of a contaminated water supply, while self-purification tends to decrease the index, Dr. Mallmann stated, suggesting further that some sort of index based on streptococcus organisms might be feasible.

A discussion of Mr. Mallmann's paper, prepared by F. W. Gilcreas, Asst. Dir. in Charge, Divisions of Laboratories and Research, State Dept. of Health, Albany, N.Y. was read by J. E. O'Brien, Senior Sanitary Chemist, Dept. of Health, Albany, N.Y.

Mr. Gilcreas agreed that no critical need exists to raise water quality standards. He pointed out that U.S. standards are more severe than in other parts of the world and suggested that streptococcic pollution as well as that of fecal origin does, in fact, exist. Among the fields that need further exploration is the mode of transmission of the viruses.

In commenting on the lauryl tryptose medium, it was suggested by Mr. O'Brien that the existing standards have been strengthened, if not actually raised.

Waterborne Diseases Still a Danger

"Waterborne Outbreaks — A Statistical Study" by Dr. Abel Wolman, Prof. of San. Eng., Johns Hopkins Univ., Baltimore, Md., William T. Ingram, Assoc. Prof. Public Health Eng., New York Univ., N.Y. and Arthur E. Gorman, San. Eng., U.S. Atomic Energy Comm., Washington, D.C. Professor Ingram presented the paper.

This report is the third in a series which thus far has covered thirty years of water-borne outbreaks in the United States and Canada. In the thirty years there have been reported 775 outbreaks affecting 250,000 persons. State and provincial sanitary engineers provide much of the assistance in validating outbreaks, while data from the U. S. Public Health Service are used extensively and contribute to increased accuracy over former periods covered.

The authors are convinced that the United States has enough water borne outbreaks to warrant continued alertness on the part of all water works personnel. A listing of the 10 communities high on the list of outbreaks indicated that emergencies result during the course of plant construction or alterations and from failures of chlorine feeding equipment.

The year 1926 was our most severe year from the standpoint of outbreaks due to failure in some part of the water supply system. The paper concluded with a listing of ten points which the authors indicate have a direct bearing on the problems of water-borne outbreaks:

1. Adequate epidemiology to investigate all outbreaks suspected of being water-borne.
2. Intra-professional cooperation in pursuing an investigation.
3. More satisfactory bacteriological tests and methods.
4. Need for supervision of recreational and private water supplies.
5. Trained operators of municipal water supplies, with no political interference.
6. Distribution system defects such as cross-connections require constant vigilance to combat the potential danger which exists.
7. Supervision of industrial plants for water piping defects.
8. Legal enforcement of existing statutes.
9. More effort should be devoted to studying and determining the cause of illnesses such as hepatitis, tularemia and poliomyelitis.
10. Constant attention is required to prevent the prevalence of typhoid fever and diarrhea.

Additional Effects of Lime-Softening

"Effects of Lime-Softened Water on Bacteriological Quality, on Main Disinfection and on Zinc-Bearing Metals" a panel discussion. The moderator of the panel was Merrill Riehl, Supt. of Water Purif., Mahoning Valley Water District, Youngstown, Ohio. The panel members were: Paul C. Laux, Supt., Div. of Water, Columbus, Ohio; Ross A. Thuma, Supt. of Filtration, St. Paul, Minn. H. O. Hartung, Plant Engr., St. Louis County Water Co., St. Louis, Mo.

Mr. Riehl pointed out that Houston, Hoover and Streeter were pioneers who had made substantial contributions to the fund of knowledge which describes the characteristics of lime-treated water. It has been known that high alkalinity water exerts disinfecting action and the speaker reported the results of controlled experiments conducted with five different waters which had been inoculated with various organisms. Consistent kill of the test organisms was accom-

*The report of this session was prepared by V. W. Langworthy, Research Chemist, The Chlorine Institute, Inc., New York, N.Y.

plished at pH 11.0 — 11.5 with four hours contact. Mr. Riehl reported the lime disinfection of water from an open reservoir was accomplished when other means such as chlorination had not succeeded. He suggested the possibility of harmful effects of high pH water on galvanized tanks, particularly where the galvanized coating is thin.

Mr. Laux discussed main disinfection at Columbus, pointing out that the causticity of the treated water varies from 0 to 20 ppm. Newly laid water mains are initially given a thorough flushing, then dosed with a 100 ppm chlorine solution. Twelve hours contact is normally sufficient to effect disinfection at the 100 ppm chlorine dosage. For mains up to twelve inches in diameter, a 12 per cent solution of high test hypochlorite is used as the basic concentration for dilution in the main. Of interest is the fact that a chlorine residual of 0.15 ppm consistently provides a water of good bacteriological quality in the distribution system.

Mr. Thuma, reporting on the treatment applied to the raw Mississippi River water at St. Paul, Minn., indicated that sufficient lime is added to precipate the bicarbonate hardness; no soda ash is used in the process. Additions of lime necessary to accomplish magnesium removal and recarbonation are controlled potentiometrically, and a five hour retention period is provided at the softening plant.

Organisms of the coliform group may be found in the filtered water at any time, and Mr. Thuma pointed out that any reduction in the five hour retention time might adversely affect such germicidal benefits as are achieved in the softening process. He does not rely on high pH water to provide disinfection in the water mains.

Purification Division Programmers

W. T. Ingram, Assoc. Prof., New York Univ., New York, N. Y.

W. L. Mallman, Dept. of Bact., Mich. State College, East Lansing, Mich.

H. O. Hartung, Plant Engr., S. L. County Water Co., St. Louis, Mo.

Ross A. Thuma, Filt. Supt., Water Dept., St. Paul, Minn.

Mr. Hartung described the treatment of Missouri river water by lime softening at the St. Louis County Water Plant, and reported safe disinfection is not accomplished at the low (2-3 ppm) hydroxide alkalinities commonly carried at the treatment plant. Records for the past ten years reveal a substantial reduction in bacterial numbers, but not enough to render the water potable.

Slides illustrated graphically that lime dosages far in excess of those required for softening at this plant would be required to render the water acceptable from a bacteriological standpoint. It was shown that water treated with lime to a pH of 11.4 reduced coliform concentration more than 99 per cent.

Mr. Hartung pointed out that excess lime dosages cause high pH concentrations which adversely effect the chlorination process. In addition, lime added in excess of that required for softening serves to increase the total hardness. He also suggested that red brass (90 per cent or more copper) be used where water with a pH valve greater than 10 is encountered, since dezincification occurs in yellow brass in that pH range.

D. B. Williams, Brantford, Ontario, asked the panel for information concerning the ability of algae and cyclops to survive in a distribution system conveying high pH water. Mr. Hartung stated that some species of algae and other forms of animal life will survive the lime-softening process.

How Many Pipes in a Pile?*

How many poles, drums, barrels, etc., in any stack?

FIG. 1

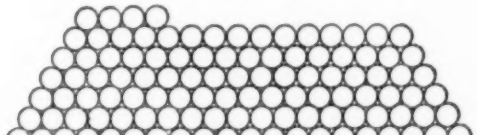


FIG. 2

Water and sewage works operators often find it their job to determine the number of pipe, rolls, rods, drums, etc., in a given stack or pile. If there are many pieces in the stack it is a time-consuming process. Sometimes it is done over and over because of "losing count," or because of errors, or due to interruptions, and so on.

Here is a short cut that will be found valuable in cases of that kind for quickly determining the exact number without counting all of them —piles as indicated in the sketches herewith.

For example if it is a triangular pile like Fig. 1 it is necessary to count only the lowest layer and multiply it by a number that is one greater. Divide by 2. That's the answer. Thus you can figure by merely counting the bottom layer of Fig. 1 that there are 28 pieces in that pile. 7 x 8 equals 56. Divide 56 by 2 and you have 28. All of which is much easier and quicker than counting all of the pieces.

For a pile like Fig. 2 make only 3 counts as follows:

A—Count the number of pipes or pieces in the lowest layer;

B—Count the number of *complete* layers;

C—Count the number of pipes or pieces in the *incomplete* layer;

D—Multiply A by 2 and subtract B from the product;

E—Add 1 to D and multiply the sum by ½ of B;

F—Add C to the result of E.

Thus referring to Fig. 2 we have: 20 x 2 equals 40; 40 minus 6 equals 34; 34 plus 1 equals 35; 35 x 3 equals 105; 105 plus 4 equals 109. And that's the answer. There are 109 pipes or pieces in that pile.

After you once get the hang of these rules you will find the method far quicker and easier than counting. For those of you who can apply algebra, this is formula for Fig. 2:

$$\frac{(2A - B + 1)\,B}{2} + C =$$

the number in the pile, where A, B, and C are the same as above.

* Contributed by W. F. Schaphorst, M.E., Newark, N.J.

pH Measurement and Control in Water Treatment Plants

Application of Modern Electrical Devices in Water Conditioning Control

by **RUSSELL H. BABCOCK,** ***Asst. Mgr., Utilities Div., The Foxboro Co. Foxboro, Mass.***

Mr. Babcock's paper provides a review of applications in which the importance of pH measurement and control has been demonstrated. The paper was presented at the latest Short School of the North Carolina Water Works Operators Assn. and is published with the permission of the Association.

THE symbol pH refers to a chemical quantity in much the same way the symbol psi refers to a mechanical quantity. Because it is a symbol, its usefulness depends upon its interpretation in terms of the process in question. If accurate pH measurements are made in water treatment processes and are interpreted correctly in the light of existing knowledge and experience, efficient operation providing better treatment at lower cost can result.

A scale of pH values has been established ranging from 0 to 14, zero denoting a strong acid and 14 denoting a strong base. A pH value of 7 denotes a solution which has neither acid nor alkaline characteristics. The strength of an acid or base is determined by the relative concentration of hydrogen ions to hydroxyl ions in its water solution. Since the product of hydrogen ions and hydroxyl ions concentration equals a constant, namely the dissociation constant, we can speak of one in terms of the other. By common practice the acidity or alkalinity of a solution is considered only in terms of its hydrogen ion concentration.

The distinction should be made between pH and acidity. Acidity refers to the quantity of a given base required to neutralize the acid present. The relationship of pH to acidity may be compared to the relationship of voltage to ampere hours, or to the relationship of pressure to quantity.

Definition

The hydrogen ion concentration of a strong acid is of the order of 100 trillion times as great as the hydrogen ion concentration in a strong base. To avoid the confusion of using such astronomical figures in comparing various solutions, a pH scale has been devised according to the following definition: "The pH value of a solution is the logarithm of a reciprocal of hydrogen ion concentration measured in grams per litre."

For example, assume that a solution has a hydrogen ion concentration of one 100-billionth of a gram per litre. The logarithm of the reciprocal of one 100-billion is 11, and the pH accordingly is 11. This is illustrated by the table which shows the pH value opposite the hydrogen ion concentration.

The table serves to illustrate the fact that since pH is an exponential value, the change of one pH unit indicates a 10-fold change in acid or alkaline strength. Thus a solution of pH 4 is 10 times as acid as the solution of pH 5, 100 times as acid as a solution of pH 6, and 1,000 times as acid as a solution of pH 7. It is important to remember this proportionally large change in acidity or alkalinty for every change in pH value. This helps to explain why relatively small changes in pH value can seriously upset a water treatment process.

Electrodes for pH Measurement

The electrometric method of pH measurement requires the use of an electrode system, consisting of a glass or measuring electrode and a calomel or reference electrode. The glass electrode consists of a shielded conductor which terminates at its lower end in a special glass bulb. This bulb is filled with a solution of known pH value. The outside of the bulb is exposed to the solution of unknown pH. The difference in hydrogen ion concentration across the glass bulb generates a potential which varies with the hydrogen ion concentration in the measured solution.

The calomel electrode consists of mercury in contact with calomel or mercurous chloride. These are immersed in a solution of saturated potassium chloride which forms the electrical connection between the calomel and the measured solution. The calomel electrode acts as a reference electrode or an electrode of constant potential. By comparing the voltage output of the glass electrode with that of the calomel electrode, a voltage representative of the hydrogen ion concentration in the solution results. Since these electrodes are capable of generating only small amounts of electrical power, an amplifier is used to magnify the amperage of the electrical signal. This voltage may then be measured by a pH recorder such as the Foxboro Dynalog pH Indicator-Recorder (Fig. 1).

Hydrogen Ions, Grams per liter	pH Value	
1.0	0	ACID
0.1	1	
0.01	2	
0.001	3	
0.0001	4	
0.00001	5	
0.000001	6	
0.0000001	7	
0.00000001	8	
0.000000001	9	
0.0000000001	10	
0.00000000001	11	ALKALINE
0.000000000001	12	
0.0000000000001	13	
0.00000000000001	14	

Relationship of pH values to hydrogen ion concentration.

Temperature Compensation

Because the glass electrode undergoes a change with temperature which affects the generated potential for a given solution pH, it is necessary to provide compensation for this change. Many individuals are familiar with the temperature dial on the laboratory pH meter. By setting this dial to the solution temperature, temperature effects on the glass electrode are compensated for. This compensation affects only the electrodes and in no way compensates for temperature effects on the solution pH. In a process installation this compensation must be continuous and automatic. This is done through a resistance thermometer bulb in the sample which provides electric compensation for this effect. Since the resistance bulb is located alongside the electrodes, it is at the same temperature.

Fig. 1—DYNALOG pH indicating recorder.

Fig. 2—FLOW TYPE electrode assembly.

Fig. 3—IMMERSION TYPE electrode assembly.

Electrode Assemblies

There are two types of electrode assemblies. The flow type is illustrated by Fig. 2. The glass and calomel electrodes, along with the resistance bulb, are retained in a flow chamber similar in appearance to a pipe tee. Flow through the chamber contacts the electrodes and resistance bulb.

Fig. 3 illustrates the immersion type assembly. The electrodes project below the assembly head and are surrounded by a guard. The assembly head can be connected to a piece of pipe permitting it to be placed in an open tank and removed when desired. Electrodes are available for use at pressures up to 30 psi and over a wide range of temperatures.

Fig. 4 illustrates the components assembled in their proper order. The voltage measurement is made and temperatures compensated by the electrode assembly. It is amplified by the amplifier and recorded by the Foxboro Dynalog pH Recorder. Notice that the electrodes are connected to the amplifier by means of special shielded cable. This is to prevent interference by other electrical equipment and is essential to the installation.

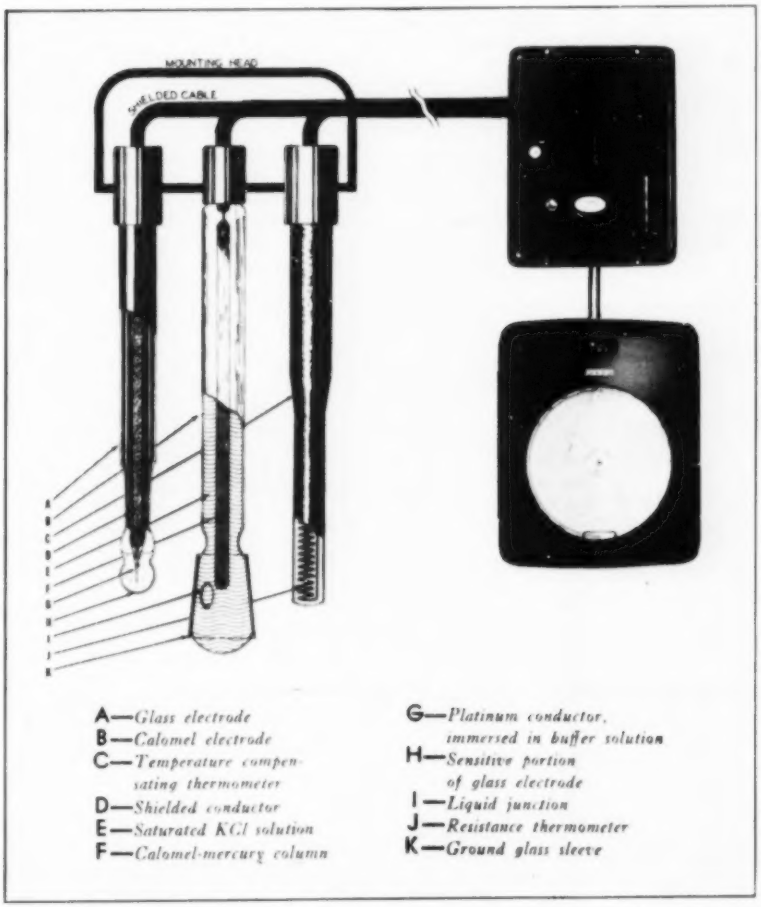


Fig. 4—PICTORIAL DIAGRAM of pH electrodes, amplifier, and Dynalog pH recorder.

Pneumatic Control

The basic parts of any control circuit are the measuring element, the control element and the control mechanism. The illustration, Fig. 5, shows a typical pH control installation, using lime to control pH. The pH is measured by the electrodes, pH amplifier, and Foxboro pH Dynalog Controller. The controller mechanism then provides an air output to a pneumatically operated valve on the discharge line so as to maintain the pH at the control point. Any change in pH causes an immediate response in the output pressure of the controller and a corresponding change in the valve opening.

If the pH drops below the control point the controller causes the air signal to the control valve to increase in pressure. This opens the valve further and increases the rate of lime feed. The increased lime raises the pH, which is detected by the electrodes and amplifier and measured by the pH controller. If the control point has been reached, then the lime feed stabilizes. If the pH is still below the control point, then the rate of lime feed will continue to increase until the

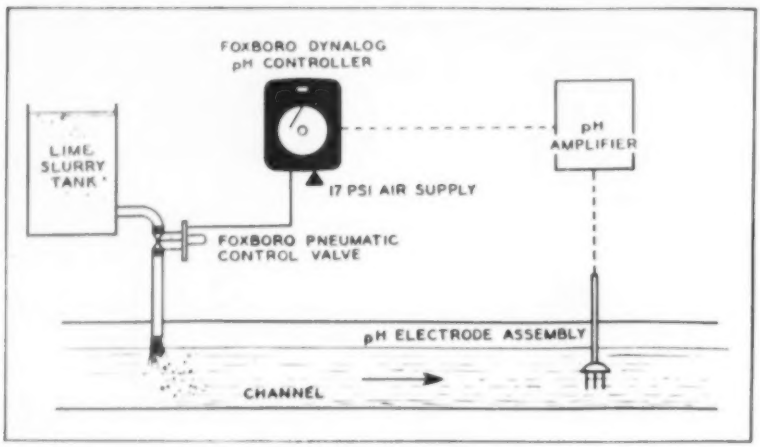


Fig. 5—ELECTRONIC pH control of lime feed.

conditions are satisfied. Conversely, if the pH rises above the control point, the rate of lime application will be continually decreased until the control point is again reached.

It can be seen from this explanation that control of lime feed or any other variable is basically satisfying demand with supply. Since measurement precedes control, it is apparent that control can be no more accurate than measurement. It is also apparent that the measurement must be representative of the process, or in this case, the pH must be measured at a point where the reaction is complete insofar as the measured variable is concerned. In this case the pH electrodes must be located far enough downstream to insure adequate mixing and reaction time.

Types of Controllers

There are basically five types of air-operated controllers: (1) on-off (2) proportional (3) proportional with reset (4) proportional with derivative (5) proportional with reset and derivative. We shall limit our discussion to the three types normally used in water works installations: on-off, proportional, and proportional with reset.

The On-Off Circuit

The control mechanism provides a means of varying the air pressure to a valve or air motor. Fig. 6 illustrates a simple on-off control circuit. It will be seen that there is a flapper and nozzle, the nozzle being fixed and the flapper being attached to the pen arm. Air is continuously bled through a restrictor and nozzle with a pneumatic relay interposed between the supply and the nozzle. When the nozzle is covered by the flapper a back pressure is exerted on the relay, causing supply pressure to be impressed on the control valve or controlling mechanism. This causes the control valve to open wide. Likewise, uncovering the nozzle vents the relay and valve, causing it to close. If the nozzle is attached to the control point index, then when the measurement is below the control point the valve is wide open, and when it is above the control point it is fully closed.

This type of control is similar in function to that used on some clear wells where the pumps stop whenever the level drops to a predetermined low point. It is the simplest type of control and applicable to many installations.

Proportional Control

In many cases it has been found that on-off control is inadequate. This has resulted in the development of the other types such as the proportional controller. These controllers cause the valve or controlling mechanism to be so positioned as to keep the measurement within a definite control band of the index. Fig. 8 illustrates a proportional controller. Notice that it

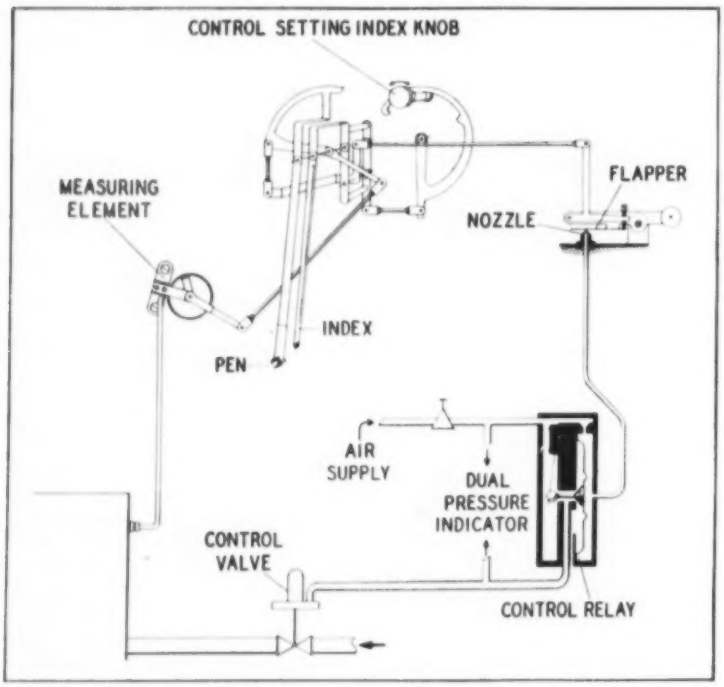


Fig. 6—ON-OFF circuit for pH control.

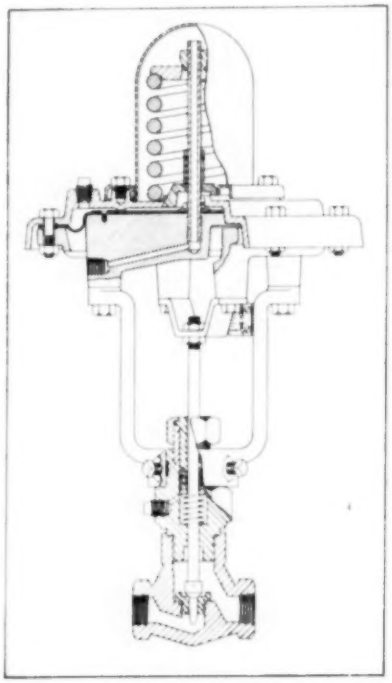


Fig. 7—NEEDLE TYPE control valve.

incorporates all the features of the on-off controller with a slightly different flapper and nozzle arrangement. In addition a bellows and opposing spring are included. As the flapper covers the nozzle the back pressure causes the relay to deliver supply pressure to the valve. At the same time pressure is applied to the proportioning bellows, which moves, causing the flapper to be moved away from the nozzle. This happens in such a short period of time that the control valve is checked in its movement to a full open position, unless the difference between the measurement and control point is large and outside of the range of the proportioning bellows adjustment.

The range over which the proportioning bellows has an effect on the controller output is known as the proportional band and is expressed as a percent of chart. For example, if a pH controller with a chart reading from pH 2 to pH 12 has its control index set at pH 6.5 with a proportional band setting at 50% the control valve would be just open at pH 4.0 and just closed at pH 9.0. At the control point the valve would be half open and at any other point between pH 4.0 and pH 9.0 the valve would be positioned proportional to the pH measurement.

From this example it can be seen that for any set of conditions the measurement would stabilize out somewhere within the proportional band but not necessarily at the control point. This is because a process change requires a new supply rate or valve position. Since the valve can only have one position or be half open when the measurement is on the control point, the measurement will stabilize out at a point where supply equals demand. This point will lie within the proportional band but not necessarily at the control point. Because of this the reset function was added, which causes the proportional band to be reset to one side or the other of the control index so the measurement follows the control point.

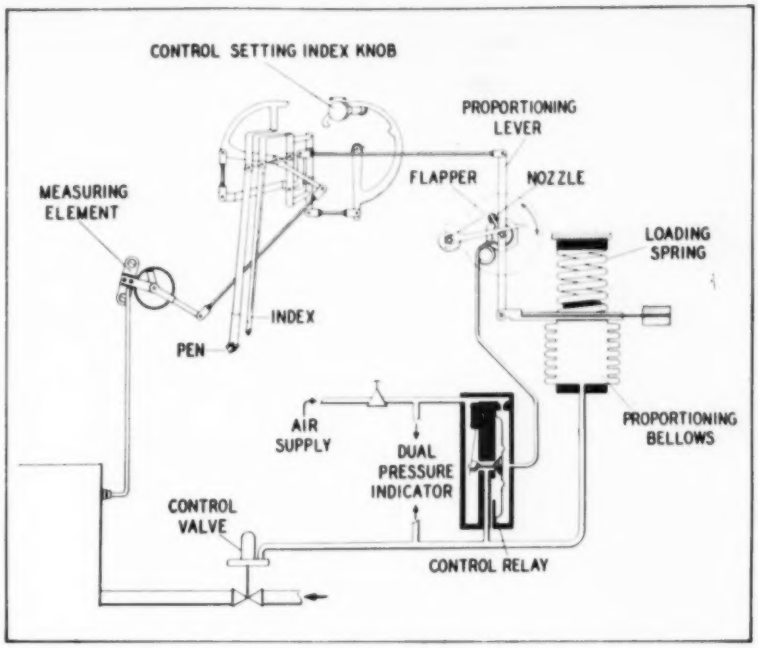


Fig. 8—PROPORTIONAL circuit for pH control.

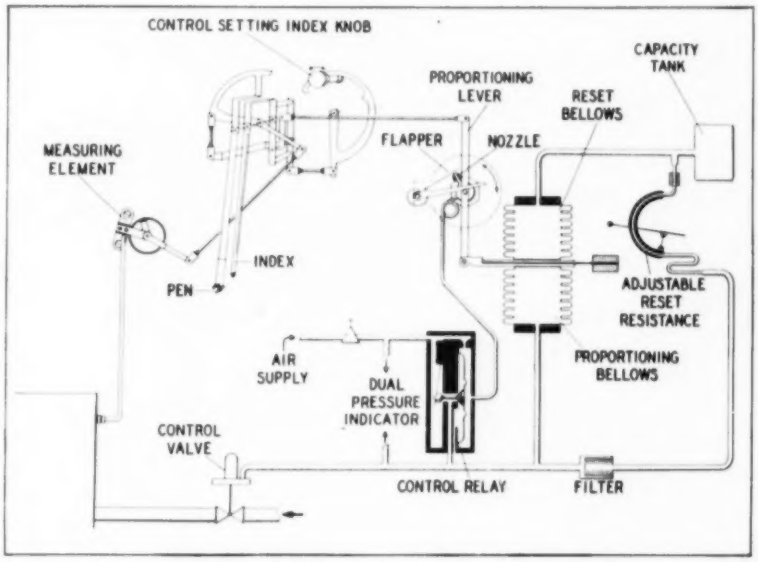


Fig. 9—PROPORTIONAL circuit with reset for pH control.

Proportional with Reset

Reset is a function of process lag time or the lag between measurement and control response. In this case it is the time it takes for a change in lime feed rate to be detected by the pH electrodes and transmitted back to the control mechanism or valve. Fig. 9 illustrates a proportional with reset controller. You will notice that it incorporates all the features previously described, in addition to a reset bellows and adjustable reset resistance. The adjustable reset resistance or time delay mechanism compensates for the lag effect. Air leaking through the resistance causes the reset bellows to expand in opposition to the proportioning bellows. This repositions the flapper with relation to the nozzle, and hence the proportional band with respect to the measurement. The proportional band is offset to one side so that the measurement agrees with the control point index. Proper adjustment of the valve of proportional band and reset results in control at the index setting regardless of changes in the process variable.

The control relay consists of a case, diaphragm, jeweled restriction, and relay valve. Air at 17 psi is provided through the upper left part of the relay. Part of it is applied to the relay valve at supply pressure. Another portion is bled through the jeweled restriction to the nozzle. The pressure on the right side of the diaphragm is necessarily lower than the supply pressure because of the pressure drop across the jeweled restriction. This is true only if there is free air passage through the nozzle. As the flapper approaches the nozzle a small back pressure is developed in the right

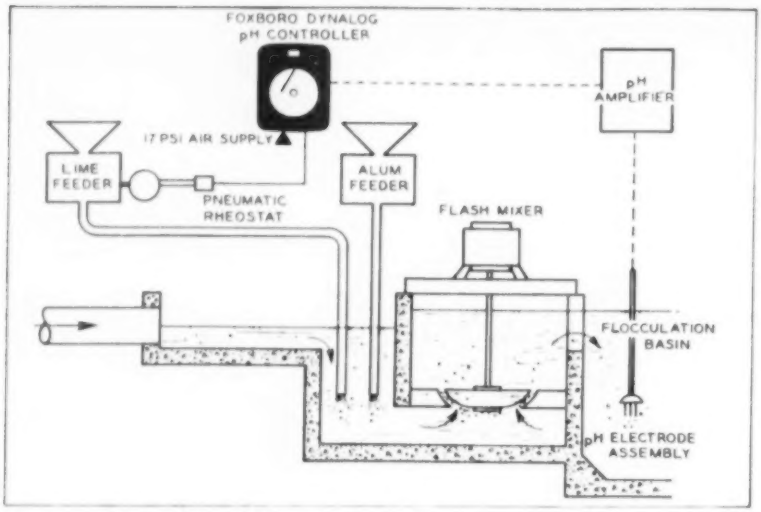


Fig. 10—CHEMICAL COAGULATION with pH control system.

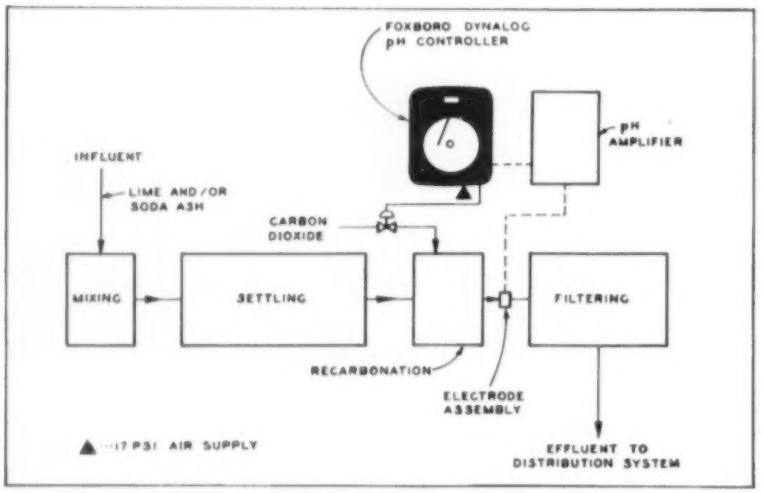


Fig. 11—RECARBONATION with pH control system.

half of the control relay. Since the area of the diaphragm is many times that of the relay valve the small back pressure from the nozzle causes the diaphragm to move to the left. This unseats the relay valve and admits pressure to the control valve line. The control pressure is a function of the relay valve displacement.

In the case of the on-off controller the relay valve is completely unsealed by nozzle back pressure, and the supply pressure is applied to the control valve. At the same time the left side of the diaphragm is isolated from the supply pressure and hence the diaphragm remains completely displaced until the nozzle is uncovered. When the nozzle is again uncovered the back pressure developed in the relay bleeds through the nozzle allowing the relay valve to seat and the control valve air pressure to dissipate through the bleed port.

In the other types of control the relay valve is positioned such as to provide the control pressure to the control valve necessary to satisfy the demands of the process. The sensitivity and accuracy of control possible with this type of instrument can be better appreciated when it is considered that the total change in the flapper-nozzle relationship required to cause a valve to go from open to close is approximately six ten-thousandths of an inch. This, coupled with modern pneumatic operators which are available for operation over a wide range of speeds, results in a degree of flexibility and accuracy virtually unattainable through mechanical means. Controllers of this type operate from a 17 psi air supply and consume approximately .5 cfm of free air.

Control Valve Construction

Fig. 7 illustrates a sectional view of a needle type control valve. This is representative of the method of construction often used in pneumatic control valves. The air motor consists of a rubber diaphragm and plate attached to the valve stem. The valve stem extension is encased by a coil spring which imposes a downward force on the valve stem. The stem extension, spring, and diaphragm are housed in a sealed chamber. The diaphragm forms the lower side of this chamber. Air pressure introduced into the chamber produces a force opposite to the spring force and the valve stem moves up until the air pressure force and spring force are in equilibrium.

The valve illustrated is of air-to-open type. Valves are also available with air-to-close motors. Selection of operating direction should be based on safe conditions during air failure. That is, an air-to-open valve will automatically close on air failure and an air-to-close valve will open on air failure.

Applications

As is well known, the treatment of surface water supplies for the removal of turbidity and color through chemical coagulation is largely dependent for its efficiency upon the pH value at which it takes place.

Coagulation Control

In general, alum coagulants operate best at just slightly below neutrality and most iron coagulants have double zones of coagulation. If chemical precipitation is being practiced for the removal of specific contaminents then pH control can improve the removal. For example: color is removed most efficiently at an acid pH. The pH value should naturally be controlled at the point of maximum precipitation and minimum floc solubility. This pH is dependent upon the mineral characteristics of the water and must be largely arrived at through experimentation. Once this value is determined, coagulation can be controlled so as to take place at this point, proceeding at a faster rate, more efficiently, and with a minimum consumption of coagulant and auxiliary chemicals.

The diagram, Fig. 10, illustrates a typical pH control system with the measurement being made just after the flash mixers. The controller operates the lime feeder in such a manner as to produce a final pH of optimum value for coagulation. In this case, the controller can serve to operate an air-operated valve so as to control the addition of a solution or can adjust the speed of operation of the

chemical feeder through the use of a D. C. motor operating from a rectified A. C. source. By using a pneumatically actuated rheostat in the circuit the speed can be controlled from the output of a pneumatic controller.

If a feeder is equipped with a pneumatic operator for changing the feed rate the output of the controller can directly change the feed rate. Several well known feeders are available with such pneumatic operators. If the character of the water changes over a period of time and it is found that there is another optimum pH control point, the feed rate is changed by merely adjusting the control index setting of the pH controller.

Corrosion Prevention

The Langlier index, or the difference between the existing pH of a water and the pH when the water is saturated with calcium carbonate, is a well known criterion for corrosion control. It is a relatively easy matter to calculate the pH of saturation for calcium carbonate from routine chemical analysis results. If a pH controller with its index at this value operates a lime feeder, continuous production of a non-corrosive finished water results. Since some waters change in chemical characteristics frequently, the index setting should be modified in response to routine chemical analysis results.

The importance of continuous control can be better realized when the effects of under and over dosing are considered. Under-treatment results in a corrosive water and over-treatment tends to deposit calcium carbonate, causing possible clogging of distribution lines and needless expense. If there is insufficient carbon dioxide and bicarbonate alkalinity to convert the lime to calcium carbonate, then it would be necessary to use a combination of lime and soda ash. But in either case, the relation of the measured pH to the pH of saturation for calcium carbonate is an effective guide for controlling the corrosive effects of a water supply.

Recarbonation

The recarbonization of softened water is a common method of preventing the after-precipitation of calcium carbonate and of neutralizing caustic alkalinity (Fig. 11). It is customary to add carbon dioxide to a recarbonation basin located between the settling basin and the filters until a pH has been reached where most of the carbonates have been converted to soluble bicarbonates and the caustic alkalinity has been neutralized. This results in a stable non-corrosive soft effluent. In order to have this process carried on so that some carbonate remains to prevent corrosion, and, at the same time, it is brought to such a point that incrustation of the filters is at a minimum, it is necessary to have pH control. In addition, this results in a minimum consumption of carbon dioxide to produce the desired effluent.

The control can take the form of a pneumatically operated control valve on the carbon dioxide line from the generators on a pneumatically operated control valve on the fuel line to the underwater burners, depending upon which type of recarbonation is practiced. This simple addition to a softening plant provides the operator with a record of the actual pH that has been maintained, as well as providing the desired type of effluent with a minimum consumption of carbon dioxide.

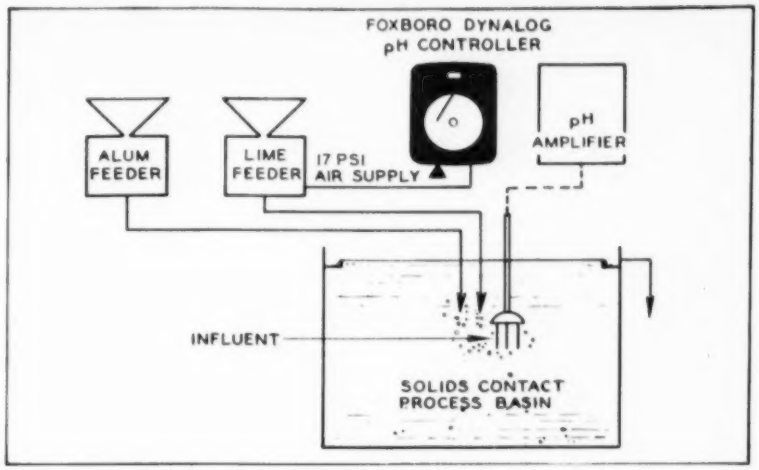


Fig. 12—SOLIDS CONTACT BASIN with pH control system.

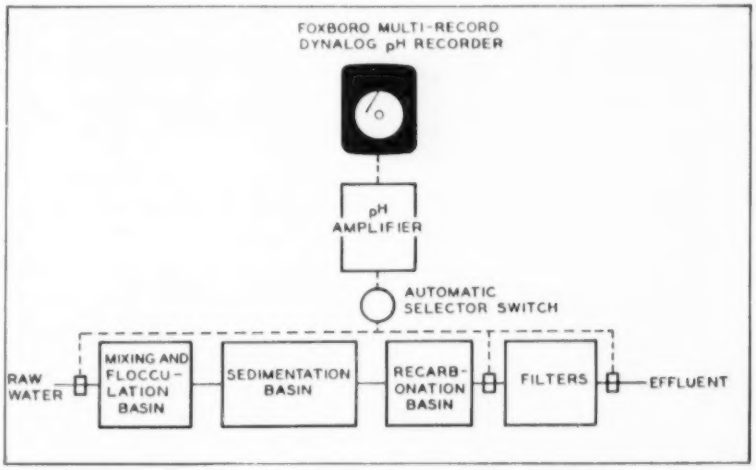


Fig. 13—SOFTENING PLANT with three-point pH control system.

Iron and Manganese Removal

The control of pH in the removal of iron and manganese from water supplies is of prime importance. Since iron and manganese usually precipitate as hydroxides it is necessary that sufficient alkalinity be present in the water to cause this to take place. This is usually much more important than the aeration of the water supplies for purposes of oxidizing the iron in that it requires only .14 parts per million of oxygen to oxidize one part per million of iron. In addition to this, it is necessary that the pH be high enough so that these compounds are readily precipitated.

In work done at Lowell, Mass., it was found that it was necessary to maintain a pH in the range of 8.5 to 9.1 in order to remove the iron and reduce the manganese to a point where the remainder could be removed on the sand filters. Failure to achieve a high enough pH value resulted in the formation of colloidal

iron oxide which was very difficult to remove. This resulted in plugging the slow sand filters. The control of pH in a solids contact process basin such as was used on this occasion is readily accomplished through the control of the chemical feeder in the manner illustrated, Fig. 12.

The pH is measured at a point shortly after the addition of lime and coagulant and the controller operates the lime or soda ash feeders so as to maintain the pH at the desired level. The experience in such problems indicates that any iron and manganese removal process involving chemical precipitation depends largely for its success or failure upon whether or not proper pH values are maintained.

In plants where automatic control is not required a multiple-record recording pH meter is of assistance in adjusting feeders and other treatment variables.

Multiple Recording

Fig. 13 illustrates an installation in a softening plant, measuring and recording pH at 3 points: the raw water, recarbonation effluent, and plant effluent. A single pH amplifier and Foxboro Multi-Record pH Dynalog Recorder is used, providing individual pH records.

Fig. 14—THREE VARIABLES on multi-record Dynalog.

This instrument provides data on pH changes of the raw supply, pH to which the water is being recarbonated, and pH of the effluent. Since all three variables are recorded on a single chart it provides permanent data which can be related to other process variables for plant study and operation, Fig. 14.

The measurement and control of pH in water treatment plants usually requires the addition of simple equipment which can result in an increase in plant efficiency and decrease in operating cost, as well as relieving the operator of the work of continually checking process values and readjusting feeder equipment. The water works industry is rapidly discovering, as other industries have, that more complete instrumentation and control of treatment processes results in improved operation at less cost.

Inspection-Demonstration Meeting Sponsored by A.W.W.A. Illinois Section

ROCKFORD, ILL. was host city to the Illinois Section of A.W.W.A. which sponsored a one-day "paperless meeting," devoted solely to inspection and demonstrations of maintenance and repair operations under the direction of H. S. Merz, Rockford's long-time superintendent of water. This inspection-demonstration type of meeting, staged June 3rd, comprises a part of the In-Service Training Program being fostered by the Illinois Section.

The demonstration began with the installation of 12" Roll-On Joint Cast Iron Pipe. Then followed the installation of an 8" valve in a main without shutting off the water pressure. This impressive installation was realistically made in the center of Rockford's business district under 65 psi main pressure.

The third demonstration comprised the freezing of service lines to stop water flow while making a repair or replacement. Freezing was accomplished with dry-ice in a period of 12 minutes and use of 5 lbs. of dry-ice. Another demonstration involved the application of an 8" mechanical split sleeve in making a quick repair to a main which had suffered a transverse break.

Then followed an excellent description and demonstration by Joe Byrd, Rockford's service repair man, of various kinks used in making service repairs. He demonstrated a novel gadget of his own invention used for repairing defective stop-cocks. He also demonstrated the location of pipe lines and services with an electrical locator; also how to squeeze off lead and copper services with another tool of his invention. All of this was considered quite impressive by the ninety-eight in atttendance. Also impressed were they with one of Rockford's deep wells which regularly yields 4,200 gallons per minute with only a 20 ft. draw down.

Ed. Note: This brief account has been drawn from a more complete report supplied by Dewey Johnson, Secy.-Treas. of the Illinois Section, who also supplied the photographs here reproduced.

ROCKFORD'S demonstrations—practical and picturesque

On left: the two lovelies are Doris Jones and Connie Wakenight with split repair sleeve and section removed from 8" main where valve was inserted under 65 lbs. pressure. On right: Joe Byrd is demonstrating special repair tools of his own invention.

In these United States most of us believe strongly in free enterprise; but sometimes we forget that freedom and duty always go hand in hand; and, that if the free do not accept social responsibility they will not long remain free.—*John Foster Dulles.*

MISSION PUMPING STATION—At left end are air intake filters and exhaust silencers

Dual Fuel Engines for Pumping Water Cut Power Costs at San Antonio

Economy of Natural Gas Proven by Three Years of Operation

by **J. A. SCANLAN**, *Assoc. Prof. of Mechanical Engineering, Univ. of Texas, Austin, Texas*

NOT far from the Alamo, a number of deep artesian wells are furiously flowing to help quench San Antonio's ever-growing thirst. Impelled by subterranean forces, this water arrives at the surface of the ground at a pressure of about 10 psi after a 1300 to 1600 ft. rise, but it still needs man's help to travel through the city's sprawling mains.

At Mission pumping station, three 390-hp dual-fuel engines driving 8 mgd centrifugal pumps are doing an increasing share of the pumping job. These units have reduced power costs more than 60 per cent, achieving the lowest operating cost in the entire San Antonio, Texas water system.

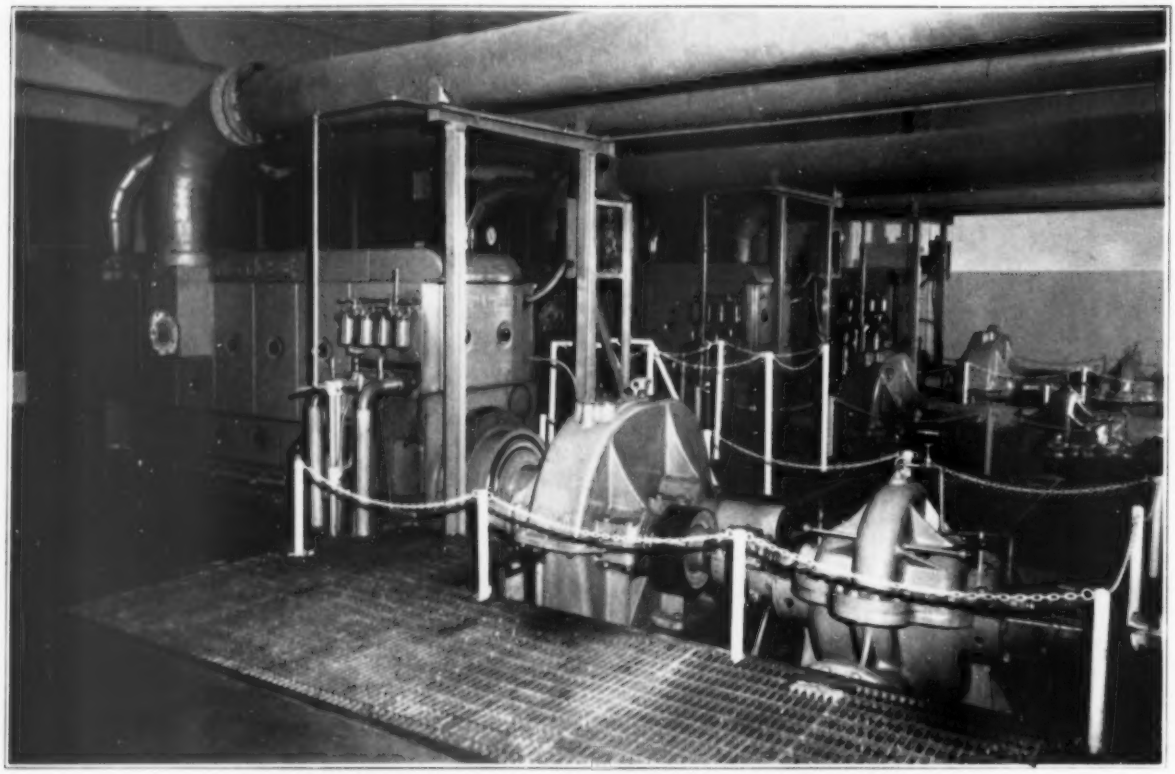
Standby to Full-Time Operation

Mission Station (officially Pumping Station No. 4) located in Concepcion Park, was built in 1922. The original station had three electric motor-driven pumps: one 8 mgd, 400-hp DeLaval; one 6 mgd, 250-hp Allis-Chalmers; and one 4 mgd, 200-hp Fairbanks-Morse. All were centrifugal pumps driven by 3-phase, 2300-volt electric motors. These pumps raised the water's pressure from its natural 10 psi to 97 psi for

Mission Pumping Station, San Antonio, Texas

PRINCIPAL EQUIPMENT SUPPLIERS

Engines	Three 390-hp., 6-cylinder, 2-cycle, Model 31AD8½, dual-fuel engines operating at 514 rpm. Fairbanks, Morse & Co.
Pumps	Three 8,000,000 GPD, 12-in. Fig. 5814, 14-in. suction, 23½-in. impeller, 1045 rpm, single-stage centrifugal, double-entry pumps. Fairbanks, Morse & Co.
Gears	Herringbone, size 11HC1, ratio 2.032 to 1. The Falk Corp.
Cooling water pumps	Fairbanks, Morse & Co.
Lube oil	Texaco ursa. The Texas Co.
Fuel Filters	Purolator Products Inc.
Lube filters	Bypass lube filters. Fairbanks, Morse & Co. Full-flow lube filters. Cuno Engineering Company.
Exhaust silencers	Maxim Silencer Co.
Air filters	Cycloil. American Air Filter Co.
Exhaust pyrometers	Alnor. Illinois Testing Laboratories Inc.
Water meters	Bristol Co.
Tachometers	Weston Electrical Instrument Corp.
Oil cooler	Ross Heater & Mfg. Co.
Heat exchangers	Ross Heater & Mfg. Co.
Governor	Woodward Governor Co.



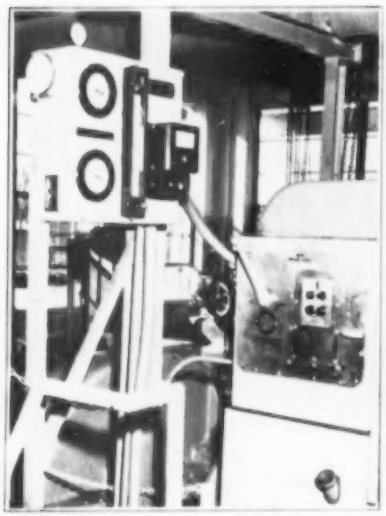
THREE ENGINES on main floor—this is exhaust side, showing fuel lines and filters. Reducing gears are in center and pumps on right.

distribution to the city water system.

The station was intended as a standby installation but rapid post-war increase in water consumption necessitated expansion and regular use of the station. In 1949, the city put into full operation three 8 mgd Fairbanks-Morse centrifugal pumps driven by three 6-cylinder Model 31AD8½ Fairbanks-Morse dual-fuel engines, each rated at 390 hp at 514 rpm. The engines drive the pumps at 1045 rpm through herringbone gears.

Within a radius of about 250 ft., there are 10 artesian wells with diameters ranging from 10 to 20 ft. and depths of 1300 to 1600 ft. All wells are connected to one 28-in. header which runs the length of the plant. The new pumps are single-stage, double-entry centrifugals with 14-in. suction, 12-in. discharge and 23¼-in. impellers. The pumps discharge into two 20-in., one 18-in. and one 12-in. outgoing mains.

Since installation of the new pumps and engines, the station has been called on for large volume service. It handled 16.5 mgd last summer with an evening peak at a rate of 22 mgd. Even in the winter, the station pumps as much as 7.5 mgd. The en-



CONTROL panel at each engine includes pyrometer and automatic alarm. Lever on engine changes from dual-fuel to Diesel operation.

DISCHARGE LINES on basement floor. On left are by-pass lube oil filters. On right are full-flow lube oil filters. Heat exchanger above is oil cooler, that below is jacket water cooler.

gine-driven pumps do the bulk of the work, and the old electric pumps are maintained in operating condition for standby service. During the first three full years of service, the dual-fuel units handled 7,317 million gal. of water.

Economy of Dual-Fuel

The dual-fuel engines, which utilize cheap natural gas as their principal fuel, demonstrated conclusively that important economies could be achieved as compared with the cost of pumping with purchased power. In the years 1949, 1950 and 1951, the engines consumed fuel costing a total of $25,356.40 in pumping 7,317 million gal. This represented an average cost of just $3.46 per million gal.

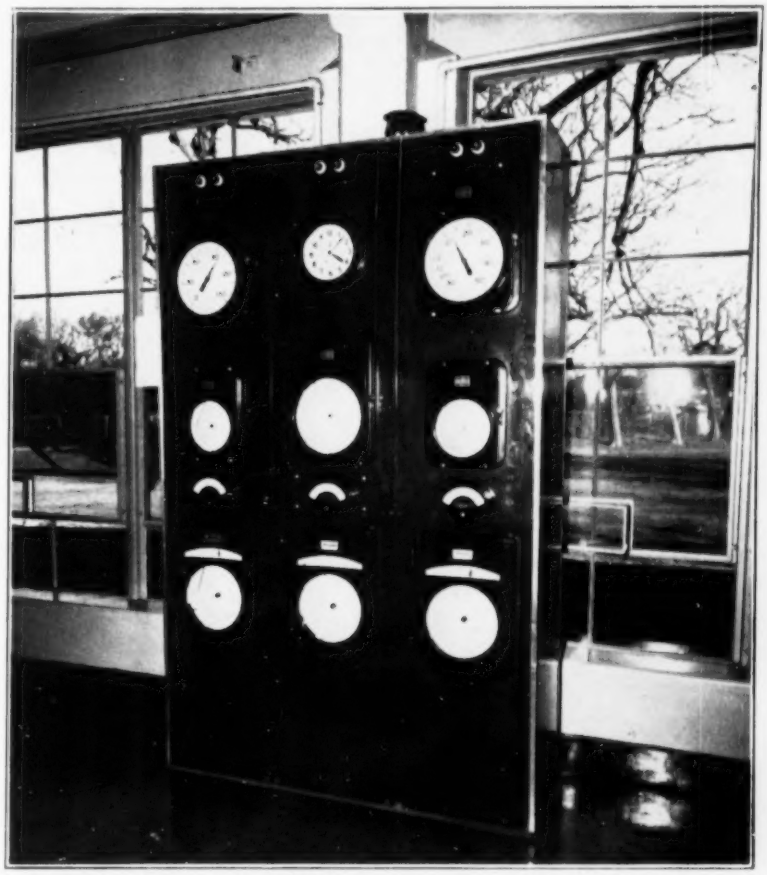
It is difficult to make direct cost comparisons since the station switched from standby and peaking service to full-time operation at the time the new equipment was installed. Including the cost of standby service from the power company, it previously cost an average of $53.10 per million gal. to pump 77.192 million gal. with the electric-driven pumps in 1949; and $21.65 per million to handle the 209.363 million gal. pumped in 1950. In 1947, the last full year of typical electric operation, the volume of water pumped was 674 million gal. and the average power bill per million gal. was $21.30.

Plant engineers calculate that the fairest figure to compare with the $3.46 fuel cost per million gal. achieved by the dual-fuel units would be about $9.00 per million gal. This would allow for the increased economy of greater volume and would exclude labor, supplies and depreciation. On this basis, the dual-fuel engines have cut costs $5.54 per million gal., a reduction of more than 60 per cent. This amounts to a saving of more than $40,000.00 for the three years 1949 through 1951.

The basis of this dual-fuel economy is efficient operation on low-cost fuel. Natural gas is abundant in Texas and these engines use just 4.6 cu.ft. of gas to pump 1,000 gal. of water. A small constant charge of diesel fuel is injected to insure ignition of the gas. Each engine uses 2 gal. of pilot oil per hour.

Engine Operation

Lubricating oil is circulated throughout each engine by a built-in pump. Included in this pressure circuit are a full-flow filter and a shell-and-tube oil cooler. Some lube is by-passed continuously from the pressure system through a multi-cartridge cellulose filter. Lube consumption has been just 2 gal. for 24 engine hours. This means a good 4,680 rated hp.hr. per gal. of lube.



CENTRAL CONTROL PANEL—dials show water discharge pressure (left) and suction (right). Each engine has corresponding recorder (bottom) for pumping rate.

The steady flow of water from the artesian wells provides an excellent source of cooling water. Raw water at 70° F. is bled from the suction header and put through the oil coolers and jacket water heat exchangers, after which it is pumped back into the line by engine-driven centrifugal pumps. Each engine has a separate soft water circuit with an engine-driven centrifugal pumping water through engine jackets and the heat exchanger. The soft water at 15 psi enters the engine at 142° F. and exits at 160° F.

Scavenging air is drawn from outside the plant through oil bath filters. Each filter uses 18 gal. of lube oil which is replaced each 6 months if conditions are very dusty. Exhaust gases vent through vertical silencers outside the plant.

Control Equipment

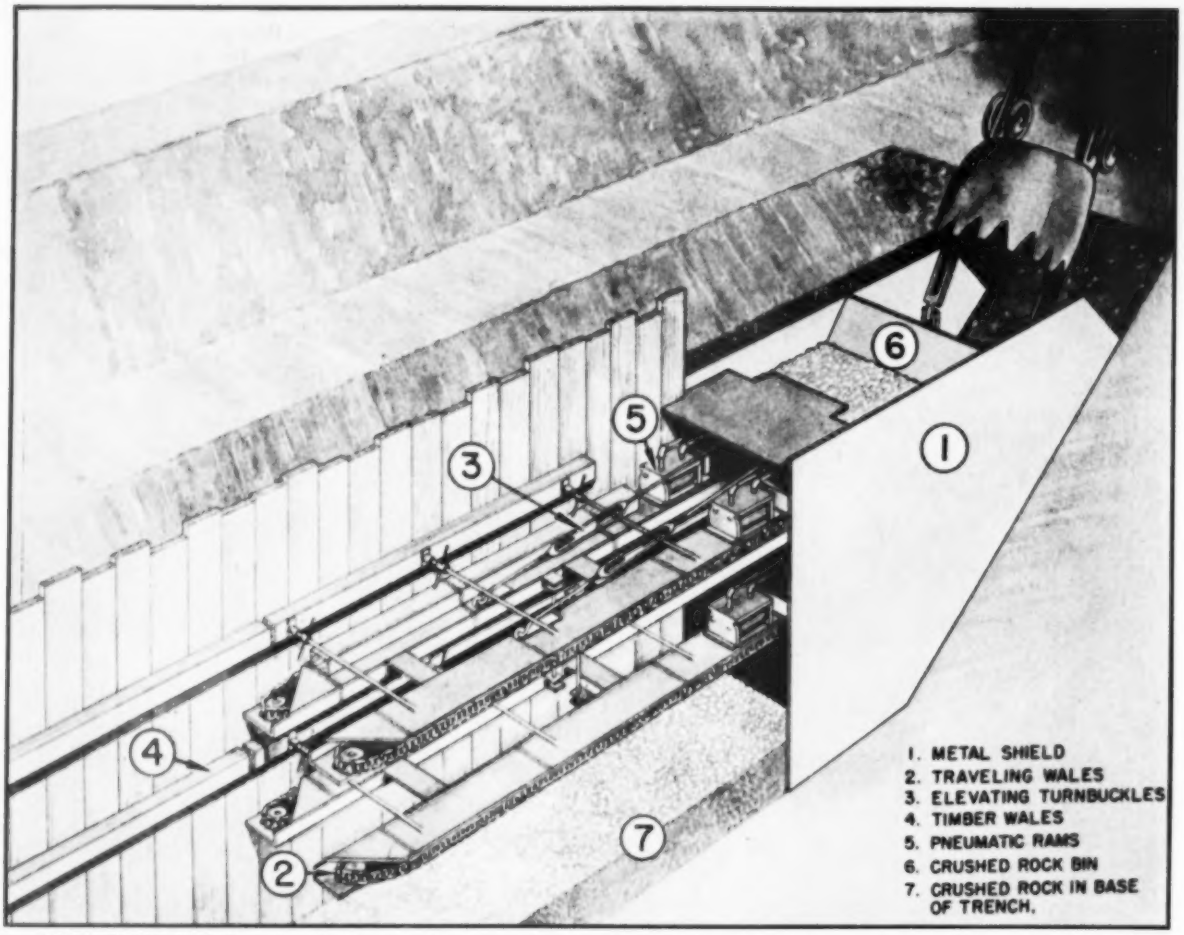
Control equipment for the plant is compact and complete. A single lever on the engine is used to stop and start the engine and also can be used to switch instantly from dual-fuel to full diesel operation. Adjoining the control lever are the governor and an emergency shutdown control.

The plant has a central control panel which indicates and records suction and discharge pressures, and pumping rate of each engine-driven pump. There is also a tachometer to show rpm of each dual-fuel unit.

Chief Engineer F. A. Sturm reports full satisfaction with the performance of the engines and pumps. Maintenance is kept to minimum by a program of preventive care.

Acknowledgement

The San Antonio water system is administered by an autonomous group of trustees known as the City Water Board. Although the Mayor is a member during his term of office, the Board functions independently of the municipal government. The system operations have been directed for more than 35 years by Manager W. D. Masterson. His assistant, R. A. Thompson, Jr., directed the design of the Mission Station.



TRENCHING RIG, featuring the new crawling wales, travels with the ladder type trenches; makes possible a rock-bedded and tight sheeted trench on a trenching machine basis.

A Method for Trenching in Wet Unstable Soil

by **AM RAWN**, *Chief Engr. & Genl. Manager*
Los Angeles County Sanitation Districts, Los Angeles, Calif.

Editorial Associate
Water & Sewage Works

A METHOD for constructing pipe trenches in sandy, water-bearing, unstable soil which permits progress at a rate of speed comparable with that under ordinary conditions was developed in the field by the Los Angeles County Sanitation District construction forces engaged in building sewers under difficult and uncertain conditions. In particular that which follows describes what has, so far, been the most difficult of sewer construction of its kind yet encountered in the Districts' system. To make the required rate of progress and stay within the estimated cost, certain features, as will be described, were added to the trenching equipment rendering it much more efficient.

The ground thru which the trench was built was fine sand, quite uniform in grain size, and saturated with water to within 3 to 5 feet of the ground surface. The trench averaged about 14 feet in depth, altho at places this depth was exceeded by some 2 or 3 feet. Open excavation with a drag line or hoe was out of the question unless the ground could be entirely dewatered with sand points. Experimental trial with well points indicated that the soil would not yield its water readily. To proceed with open excavation without draining the water out would have been impractical because, under such circumstances, the trench walls would have caved excessively. To do the job with square sets and clamshell was possible but slow and expensive The District forces, having had wide experience with working a shield in wet trenches, devised the rig which is shown in the accompanying picture. With it they were able to complete from 200 to 300 feet of sewer construction per day and place the pipe on a good gravel foundation in a trench entirely free from water.

The Rigging

The picture is a drawing of the

rigging that was used. The shield (1) in the picture is attached directly to the digger boom. It is made of well braced 5/8 inch plate and tapered slightly so as to be possibly one-half inch wider where it joins the boom than at the finished trench end. The leading edges are sharpened. Attached to the shield are travelling wales, (2) and it is the crawling wale which permitted rapid construction for the following reasons:

Prior to use of the equipment on the job being described, District forces had used similar equipment elsewhere except that the travelling wales slid along the sheeting instead of crawling along it as is the case with the pintle chain idea. This permits the pressure to be maintained on the sheeting but without the tendency to drag the sheeting along with it. Dragging the sheeting along with the moving digger tends not only to place undue strain on the boom but opens cracks between sheeting, which in the soil encountered in the construction being described would have promptly resulted in trench caving.

The shield and the travelling wales are dragged along by the digger. The shield protects the trench sides until timber can be placed as shown in the last timber just to the right of the figure (5). This timber is entirely within the shield itself and after it is dropped into place two pneumatic rams fit it up snuggly to the next timber behind and hold it there as the trencher proceeds and the shield moves forward.

When the shield has moved forward sufficiently to permit placing another stick of sheeting, the pneumatic rams are retracted sufficiently far to drop the sheeting into place and the process repeated. The ram operating platform in very deep trenches is sometimes out of sight in the picture between the sides of the travelling shield but in shallower trench work is on top of the operating platform shown.

As the digger moves forward the travelling wales hold the sheeting in place until timber wales (4) can be placed. Additionally, bedding-rock drops into the trench base from the hopper (6), thus providing a dry solid working base for the pipe (7). The travelling wales are moved vertically as required by means of the elevating turnbuckles (3).

Economics

This brief narrative which is probably better told in the picture than otherwise is passed on for whatever value it may have under similar circumstances elsewhere.

Before the job being undertaken by District forces, tenders were called for. All bids were rejected and the job completed by District forces for 71 per cent of the low bid submitted.

Harry Chapman, superintendent of construction (also operation and maintenance) on the Districts' system, is largely responsible for the equipment's design and construction, altho something similar to it has been in the process of evolution in District construction for nearly 30 years. C. R. Compton, Assistant Chief Engineer, is in charge of construction.

Ladies and Gentlemen: the President of the United States . . .

And a "passel" of editors

This picture, made in the White House gardens just outside of President Eisenhower's office, shows the President after his press-conference with this group of editors who represent the technical press of the United States and Canada. This group of top editors represent what has been commonly termed "trade magazines" but more modernly referred to as "business publications." The magazines here represented are member publications of the Associated Business Publications of America of which *Water and Sewage Works* is proud to be a member.

This group of editors gather at intervals in Washington to discuss with key officials topics of current interest in confidential off-the-record interviews for background information and a better understanding of the problems of the Government and how industry may help in solving some of these problems.

"Twelve-to-One" That This Story Fits Some of Your Operations

A prominent manufacturer has been using the same engine in his plant for the past fifteen years. The engine is used for driving a generator which in turn furnishes light to the plant. It is equipped with a lubricator of one quart capacity.

The important thing to the reader who is interested in economy is the fact that for fifteen years this company followed the set procedure of using 12 drops of oil per minute in the oiling of this engine. After some persuasion, the owner ordered an investigation into other oils which cost considerably more per gallon. It was found that 12 drops per minute could be reduced to one drop per minute by using a higher grade oil. They have been using only one drop per minute ever since, and, what is more, the engine cylinder shows better lubrication.

This once more affirms the oft repeated declaration that "ultimate cost is more important than first cost." Of course this more expensive oil does not cost twelve times as much as the cheaper oil, but it goes twelve times as far, plus better service.

It is very likely true that many of us are using low priced products which in reality are more expensive than is realized.

Contributed by W. F. Schaphorst, M.E., Newark, N.J.

Safety in Sewage Works Maintenance and Operation

The First of a Series

by **LEROY W. VAN KLEECK**, *Prin. Sanitary Engr., Conn. State Dept. of Health Hartford, Conn.*

ACCIDENTS do not just happen—they are caused! Common sense, thoughtfulness, and an application of basic principles will prevent accidents in any field. This series of articles on employee safety in the sewage works field will, it is hoped, give these basic principles and lift you over the bumps, but just reading them won't help much—you'll have to *think* and *practice* safety.

Fig. 1—PROTECTIVE water-proof felt lined rubber work gloves
Are important in sewer and plant maintenance.

You've heard of the conference idea? It works with safety too. Put questions on safety to your employees; get them thinking and talking safety and out of hiding come the hazards. Safety is everybody's business—the superintendent and his employees must work as a team.

Frequency of Accidents

While the occurrence of accidents in any particular sewage works department seems infrequent, the actual frequency on a country-wide basis is far greater than is often realized. The Federation's Manual of Practice No. 1[1] gives insurance data showing the trend of accidents in this field. The sewage works deaths reported are considerably higher on a man-hour basis than those occurring in machine shops, a standard classified industry.

The 1951 report of the National Safety Council sheds further light on occupational accidents occurring in the United States during 1950. During that year there were 13,300 occupational deaths and 1,875,000 nonfatal occupational injuries. The rate in the public utilities field was 30 deaths and about 2000 injuries per 100,000 workers. About 275,000,000 man-days of time was lost plus $2,500,000,000 in lost wages. In addition, the Council estimates that some $1,300,000,000 of property and production lost occurred.

The accident record in 1950 also indicates that for every working hour about 2 deaths and over 200 compensation injuries occurred, all directly connected with occupational accidents. Accidents occurring in homes or attributable to automobiles were not included.

Oxygen deficiency continues to be a major hazard in manholes. Orland[2] aptly describes the sewer manhole as a deathtrap or civilian counterpart of the infamous war-time "booby trap," whereby unthinking individuals are made to accomplish their own destruction through uncautious action. The numerous deaths in recent months in manholes devoid of sufficient oxygen to support life bear witness to this ever-present hazard.

Fig. 2—HAZARDOUS position in which to leave a manhole cover.
Can cause serious injury.

Fig. 3—APPROVED type of safety belt
Should be worn when entering all manholes or pits greater than 8 feet in depth.

Reported deaths from this hazard have totaled not less than 12 in the past two years. The most recent deaths have occurred in Winona, Minn., Rochester, N.Y., Minneapolis, Minn., and Lansing, Mich. In many cases, several deaths have taken place in a single manhole caused by foolhardy attempts at rescue without proper respiratory protection. In other recent accidents workers have suffered collapse in manholes deficient in oxygen and were miraculously revived.

Hazards

Their Nature

In sewage works maintenance and operation, workers in sewers, booster sewage pumping stations or sewage treatment plants are subjected to:

1—Physical injuries.
2—Body infections.

(1)—Manual of Practice No. 1, "Occupational Hazards in the Operation of Sewage Works," Federation of Sewage Works Associations, 325 Illinois Building, Champaign, Illinois, page 6.

(2)—"Manholes are Deathtraps," Herbert P. Orland, Sewage & Industrial Wastes Journal, June 1951, page 801.

Fig. 4—SAFETY outfit, such as worn by miners

Note safety cap-lamp; also safety flame-lamp for detecting explosive or oxygen deficient atmosphere. Such flame-lamps should, however, never be used in sewers for reasons to be discussed in a later installment.

3—Dangers from noxious gases or vapors and oxygen deficiency.

4—Radioactive hazards.

Their Control

Hazards may be avoided by proper design, safe practices and the proper use of safety equipment. It is not the intent of these articles to discuss design. For a review of safety design features, the reader is referred to the before-mentioned Manual of Practice No. 1 published by the Federation of Sewage and Industrial Wastes Assns.

Part I
Employee Safety in Sewers

Section A
Prevention of Physical Injuries

Traffic Handling

It is generally through manholes in the street that workmen enter sewers for inspection or cleaning. The thoughtlessness of the general travelling public toward the safety of utility workers requires full protective measures from traffic hazards.

Warning signs and red flags should be prominently erected at a suitable distance on each side of the manhole. Where the traffic is heavy and moving fast, employees with flags should slow down and detour vehicles from the vicinity of the manhole. In wide streets the service truck may be parked so as to afford protection from one direction. Sufficient workers for the job at hand should be provided. The latter can not be given too much emphasis.

Night work requires adequate illumination in the vicinity of the open manhole shaft. Such lighting may be afforded from spot lights mounted on service trucks or from several available models of portable electric generator sets as battery-operated lamps.

A manhole cage provides additional employee protection during prolonged operations, not only from moving traffic but as a means for easier descent and ascendance of the manhole shaft.

Removing Manhole Covers

The tools for removing manhole covers must be suited to the job and in good repair. A hook lifter is the best tool, especially for removing covers with ventilating holes. This tool has a tempered point for insertion into a ventilating hole, and the cover may be removed with a pull by one man. A lifter made of ⅝-in. diameter stock, 18 inches long, and equipped with a loop handle is a handier and safer tool than a pick. Picks may slip and injure a workman's feet. When driven hard against a cover they may also create a spark which is a hazard in the presence of flammable gas emitting from the sewer.

Unless the cover is oversize and very heavy it is better that one workman remove it. Men working in pairs may drop the cover, if their actions are not perfectly coordinated, and cause injuries to feet or hands. Handling of objects of all types is the major cause of compensation injuries—this should always be borne in mind. Heavy work gloves are a protection to the hands—(Figure 1).

After removal the cover should be left clear of the manhole shaft. A serious fall may occur to a workman stepping on a cover only partially removed from the opening—(Figure 2). Falls of all types are the second largest cause of compensation injuries.

In replacing covers they should be pulled with the hook lifter into place or lifted with gloved hands for dropping into place. Workmen often need to be taught how to safely lift manhole covers and other heavy objects. The workman should bend his knees and lift mainly with the leg muscles, rather than place the strain on his back and abdominal muscles. This procedure is of material aid in avoiding back injuries and ruptures.

Descending Manhole Rungs

The width of the manhole rungs, their vertical spacing and the toehold they afford should be carefully noted before descending. If the rungs have been set in a stagger pattern, rather than vertically aligned, unusual care should be taken to avoid falls during the descent. If the condition of the rungs is unfamiliar to the workman, each rung should be tested for soundness during the descent. After the galvanizing wears off, many rungs rust and become weakened. A fall may result. Rubbers on the feet help to prevent slips.

In some communities rungs are not provided in manholes and portable ladders are used for access. Such ladders should be very carefully set on the side shelves of the manhole floor to prevent slippage and the ladder

Taking note of the conspicuous record, not a good record, of accidents and fatalities in sewer maintenance and sewage works operation, it appeared timely to arrange for a series of refresher articles on "Safety in Sewage Works Maintenance and Operation." This is the first of the series slanted especially to foremen of sewers and superintendents of sewer systems.

In looking about for an author who might most competently produce this series on Safety, who else but the chairman of the Federation of Sewage Works Associations' "Committee on Occupational Hazards in the Operation of Sewage Works" could this be. We, therefore, feel that we have been most fortunate in getting chairman Van Kleeck to produce this series of articles for *Water & Sewage Works*. Practically single-handed Mr. Van Kleeck developed Manual No. 1—"Occupational Hazards in Sewage Works" for the Sewage Works Federation.

This present series of articles will without doubt contain basic material which also appears in the Federations Manual No. 1 of 1944; but, in addition, those innovations and advances in safe practices in the maintenance and operation of sewers and sewage plants which have developed during the years intervening.

Fig. 5—APPROVED type of safety-lamp for use in sewers, digester, etc.

Current is supplied by re-chargeable wet battery. See photo of recharging rack on next page.

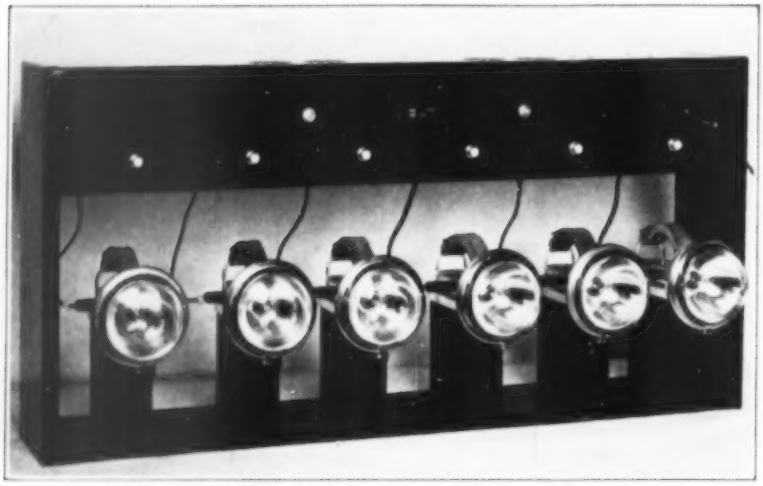


Fig. 6—RECHARGING safety-lamps with ordinary 115 volt alternating current. Single lamp charging units also available.

should be held firmly at the top by a workman, while a co-worker descends.

Using Safety Belts

Workmen should wear safety belts in all manholes having a depth more than 8 to 10 feet—(Figure 3). In all rescue work, whether the result of physical injury or unconsciousness from noxious gas exposure or oxygen deficiency, belts are invaluable, for the victim so equipped may be safely and quickly raised to the surface for emergency treatment. Many of the lives lost in sewers could have been saved by this simple expedient. TWO men should always be stationed at the top of the manhole to lift a workman. This is no job for one man.

Note: The importance of safety belts in saving lives, as a result of noxious gases or oxygen deficiency, is to be discussed in more detail in a later section.

Proper Lighting in Manholes

On clear days good lighting may be obtained in the bottom of manholes by the use of a sun-reflecting mirror. A mirror about 6 or 8 inches in diameter gives a good light. Even in the shadow of buildings, two mirrors may be used to transmit light from the sun to a manhole shaft. Otherwise, a portable safety lamp or a safety cap light on the workman's head (Figure 4) is recommended for sewer illumination. Even in the apparent absence of flammable gases, as determined by tests, good practice dictates that only explosion-proof approved lamps be used in sewers. (Figures 5 & 6). Ordinary flashlights or portable battery lamps of ordinary design may cause a spark from the control switch, or an exposed hot filament from a cracked bulb may serve as a source of ignition should flammable gas accumulate in the manhole.

First Aid

The service truck should carry a first-aid kit (Figure 7), potable drinking water and splints. Lacking two-way radio, emergency phone numbers should be listed in the truck, including the police, fire department and several ambulance and doctor numbers. The foreman of each sewer gang needs adequate training in first aid. The Red Cross courses, widely available, provide such training.

Section B

Prevention of Body Infections

Potential Hazards

Although everyone is always subject to infections, sewer workers in contact with sewage are exposed not only to the usual hazards, but also to the hazards from the "water-borne" diseases. These diseases include typhoid fever, para-typhoid fever, amoebic dysentery, infectious jaundice and other intestinal and pus-producing organisms. The danger from tetanus is also present.

First-Aid

The need for first-aid kits and Red Cross instruction has been mentioned. A 2 per cent tincture of iodine or tincture of methiolate should be mandatory treatment for immediate use on all minor cuts or wounds. No cut or scratch is too small to warrant such treatment.

Some persons are sensitive to iodine. Iodine tincture also becomes strong with age, because of evaporation of the alcohol used as a solvent, and may therefore burn wounds. For these reasons, the methiolate solution, or similar proprietary medicines, are largely replacing iodine as an emergency antiseptic.

Except for injuries of a minor nature, wounds should be treated promptly by a doctor.

Wearing Apparel

Work gloves protect the hands from minor wounds. Work clothes or cover-alls should also be worn. Rubbers reduce infections by keeping the feet dry and the shoes clean.

Personal Precautions

Smoking should be banned in sewers. It is practically impossible to avoid contamination of the ends of pipes, cigarettes or cigars. Smoking is also a potential hazard as it affords a source of ignition for any flammable gases which might be present, or which might accumulate during work.

Fig. 7—FIRST-AID kit suitable for sewer maintenance and service trucks.

"Keeping the hands below one's collar while at work in sewers" is an excellent rule. A majority of infections reach the body via the mouth, nose, eyes or ears.

The hands of workmen should be washed after sewer work and before smoking or eating. Potable water, wash basins and paper towels may be carried on the service truck or the men should be transported to headquarters where hot water and soap are available. When in the field, soap preparations requiring no water rinse are available. They are particularly useful in freezing weather.

If drinking water is supplied in the field, a common pail and dipper should be avoided and are often prohibited by sanitary regulations. Covered containers equipped with faucets can be secured, and individual paper cups may be used. The common drinking pail and cup spread infection between workers.

Many sewer departments give typhoid inoculations to their workers. They are recommended as an additional precautionary measure. A course of three injections of typhoid vaccine is repeated at intervals of not over three years, or stimulating doses of 0.5 cc. of triple toxoid vaccine, administered subcutaneously, may be given annually.

Because of the potential danger from tetanus, tetanus toxoid shots might be considered for those continually working in sewers. For protection against tetanus a course of two injections of tetanus toxoid (one month apart) is repeated every 5 years.

Acknowledgement: Photographs used for Figs. 1, 3, 4 and 7 were supplied by Mine Safety Appliances Co. of Pittsburgh, Pa. Those used for Fig. 5 and 6 were supplied by Koehler Mfg. Co. of Marlboro, Mass.

The next article will deal with the prevention of dangers from noxious gases or vapors and oxygen deficiency in sewers.

Plastic Pipe for Cannery Effluent Irrigation

A plastic irrigation system has been installed at the Hipke Foods, Inc., cannery at Mt. Calvary, Wisc. The system utilizes large amounts of waste water, produced in canning operations, to irrigate food crops. It was installed by two workmen in a period of only two hours, and is estimated to cost one-half as much as a similar system of metal piping (taking into consideration initial cost, fittings, and labor).

In addition, the plastic pipe system is flexible, because the lateral lines can readily be swung from one location to another as the ground becomes saturated. Because the pipe is guaranteed against rot, rust and electrolytic corrosion, this system is expected to withstand the high acid content of the canning process waters and the corrosive action of the soil far better than one of metal pipe.

The system consists of two 50-foot mains of 3-inch and two 100-foot laterals of 2-inch plastic pipe, together with plastic tees and plugs. Six sprinklers, which are placed about 30 feet apart, are each capable of handling about 12 gallons of water per minute with a residual operating pressure of 25 psi. The entire system handles approximately 4300 gal. per hr. The centrifugal pumps were set to insure a capacity of about twice the amount of water that enters the pump well. To prevent the possibility of the sprinklers from turning over on the pipe and tees, wooden stakes were driven into the ground alongside the tees.

The flexible plastic pipe used is Carlon "E." It is supplied in long lengths (up to 400 feet) which require fewer fittings and curves to follow irregular ground contours. Because these lengths can be sawed off at any point and fittings attached, sprinklers can be spaced wherever desired. Extensions of an existing system can be made at any time by merely adding a length to the main lines and attaching laterals to discharge water where needed.

"Water for Beauty"

The St. Louis County Water Co. can well take pride in a most attractive quality booklet, bearing the title "Water for Beauty," which has been especially prepared for distribution to customers.

The full title of the green jacketed booklet is "Water for Beauty of lawns, trees, shrubbery and gardens." It was prepared by August P. Beilmann, manager of the Gray Summit Arboretum of the Missouri Botanical Gardens and president of the St. Louis Chapter of Friends of the Land.

As stated in the foreword by the St. Louis County Water Co. the intent of this booklet is—"To help you get the best possible results as you tend the growing things around your home and use water from mains to supplement rainfall, we have published this booklet. . . . You will find it pleasant reading, we know. We also hope that you will find in it some valuable ideas which will make your gardens the more beautiful."

This copyrighted top quality booklet of 12 pages and jacket is an attractive 5¾x7¾ inch size replete with sketches illustrating when to water, how to water and how much to water various plants, shrubs, trees and lawns. As a public relations job it rates high on our list. Any water works man who hasn't seen a copy of "Water for Beauty" will find it inspirational as well as useful in his own sprinkling and watering program. Not knowing what the supply situation is we may be in for trouble by saying write for a copy. The address is St. Louis County Water Co., 6600 Delmar Blvd., St. Louis 5, Missouri—attention, W. Victor Weir, President & Gen'l. Mgr.

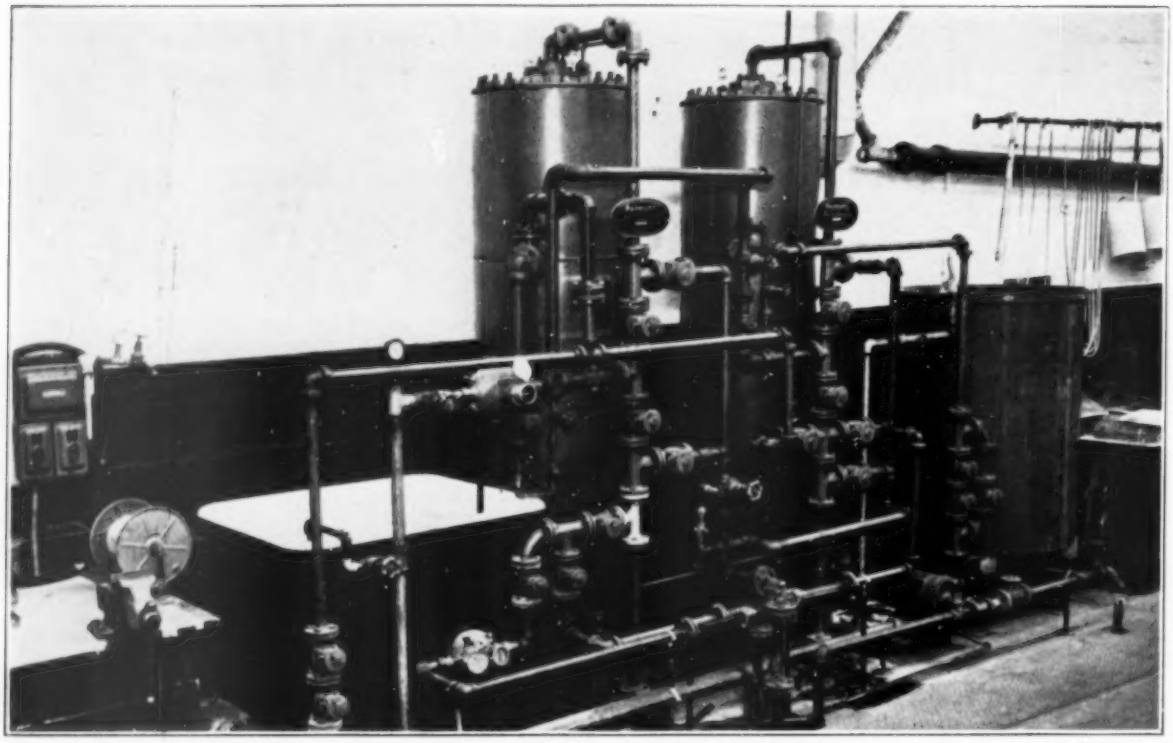


Fig. 1—CHROMATE RECOVERY by ion exchange in plant of Grumman Aircraft Engineering Corp., Bethpage, N.Y. Cation exchange unit on left and anion unit on right. Tanks are steel and have sprayed polyethylene linings. Steel pipes and valves are lined with Saran rubber.

Synthetic Ion Exchange Materials in Industrial Waste Treatment

A Review of Their Applications, Limitations and Economy

by A. B. MINDLER, *Special Applications Engineer, The Permutit Co., New York, N.Y.*

ION exchange is perhaps one of the oldest of nature's "unit operations." Ion exchange processes have apparently been taking place in soils for millions of years. However, it is only during the last 40 years that these processes were employed commercially in water treatment. Application of ion exchange operations outside the field of conditioning water is only about 20 years old. The greatest impetus to the adoption of ion exchange outside the field of conditioning water was the development of organic ion exchangers, including sulfonated coals and ion exchange resins.

The applications of ion exchange may be summarized as follows:

Removal of undesirable ionic impurities from solution
Addition of specific ions to solution
Recovery or concentration of valuable substances from solutions
Separation of electrolytes
Use as solid contact agents or *catalysts*

Ion exchange may be defined as "a reversible interchange of ions between a liquid and a solid involving no radical change in structure of the solid."

Types of Ion Exchange

The types of ion exchangers available may be separated into two broad classes of cation exchangers and anion exchangers. A number of different types of cation exchangers are available including:

Inorganic cation exchangers
Sulfonated Coal
Sulfonated Resins
Carboxylic Acid Resins

The anion exchangers may be separated into types in accordance with the basicity of the active groups. Thus, there are weakly basic anion exchangers, strongly basic anion exchangers, and those of intermediate strength.

Each ion exchanger passesses properties and characteristics peculiar to itself. Therefore, for each application there is one best fitted type.

General Principles of Waste Treatment

In the treatment of wastes by ion

This paper is based on a talk given by the author before a meeting of the Metropolitan Section of the New York Sewage and Industrial Wastes Association.

Table I

EXAMPLES OF METALS IN INDUSTRIAL WASTES AND ION EXCHANGE APPLICATIONS

	Cation Exchange	Anion Exchange
Acid Solutions	Copper, zinc in rayon plant wastes. Copper, nickel, zinc, lead in acid mine waters and acid plating wastes.	Chromic acid in anodizing etc. Iron chloride complexes.
Neutral Solutions	Many plating wastes	Chromate salts.
Alkaline Solutions	Copper amine in rayon plant wastes	Stannate salts in electroplating. Gold and silver cyanides in plating and ore refining. Silver thiosulfate in photographic wastes.

exchange a few important generalizations may be cited.

Unless some relatively valuable material can be recovered for sale or re-use, ion exchange generally is not an economical method of treating wastes. The recovery of such valuable materials may be accomplished by either of two methods:

(1) Removing electrolytes present in extremely low concentrations by ion exchange, and subsequently recovering the concentrated electrolytes from the exchange material. An example of this is the recovery of metals or organic acids.

(2) Recovery of valuable products in waste materials by removing harmful impurities; such treated solutions may then be concentrated or further processed for sale or re-use. An example would be the demineralization of pineapple mill juice for the production of sugar syrup.

The treatment of waste solutions by ion exchange should be practiced at the point in the process, where interfering electrolytes are at a minimum, in order to obtain most effective treatment at lowest cost for regenerants. Generally, the waste solution to be treated should be relatively clear and free of turbidity so that deterioration of the ion exchange materials is minimized.

In treating wastes by ion exchange, it is important to bear in mind that the regenerant solution resulting must be of such a character that it can be disposed of readily. Certain types of wastes undoubtedly can be purified by ion exchange, producing a valuable effluent for re-use, but the regenerant effluent would be just as harmful for discharging into streams as the original wastes. In such cases further concentration of the regenerant effluent may be feasible.

Applications

Among the applications in which ion exchangers may be used in waste treatment are those for the concentration of copper and zinc from textile wastes. In the cuprammonium rayon industry, extremely large quantities of water bearing low concentrations of copper formerly were sent to waste. This copper is now being recovered by a large ion exchange plant and the recovered copper is re-used in the process. Likewise, zinc is being recovered for re-use from the regenerated cellulose hardening baths and from rinse waters in viscose operations. Other metal constituents in wastes on which considerable work is being conducted are listed in Table I.

Other substances besides metals may be concentrated and recovered by ion exchange: among these are alkaloids, organic acids, potassium acid tartrate, and various amines.

In the treatment of wastes by the removal of undesirable impurities from solutions containing valuable constituents, the demineralizing process is generally employed. There is only one commercial scale installation for operating this process, and that is the demineralization of pineapple mill press juice for the production of a sugar syrup for sweetening pineapples. Considerable investigation has been done in the purification of other fruit wastes, cheese whey, and various solvents.

Chromate Recovery

Perhaps the process for which ion exchange has been most widely used in waste treatment is in chromate recovery from plating or anodizing wastes. The plating or anodizing bath is primarily chromic acid. In this application, ion exchange may be applied in two ways.

First the chromic acid baths may be freed of aluminum cations or other cations which gradually build up in the baths. This is done by passing the impure chromic acid solution through a bed of Permutit Q, a sulfonated polystyrene copolymer, thus exchanging hydrogen ions for the metal cation impurities. Chromic acid is produced from the chromate salt and the bath maintains its full efficiency for an indefinite period of time (chromate additions are required equivalent only to that lost by dragout and on the plated or anodized piece of metal).

The plated or anodized piece of metal is then passed through several rinses of water. Consequently, the rinse water picks up chromic acid and this is the second place where ion exchange is employed. A bed of Permutit S, a highly basic quaternary ammonium anion exchange resin, exchanges hydroxyl ions for the chromate anions to form water. The chromate anions are concentrated on the Permutit S. When the anion exchange resin capacity for removing chromic acid has been exhausted, it is regenerated with sodium hydroxide. The chromate in the regenerant effluent is present as sodium chromate. This solution is passed through a hydrogen exchanger to convert it back to chromic acid, which is added to the plating or anodizing bath.

Cation and anion exchangers of the type described are illustrated in Fig.

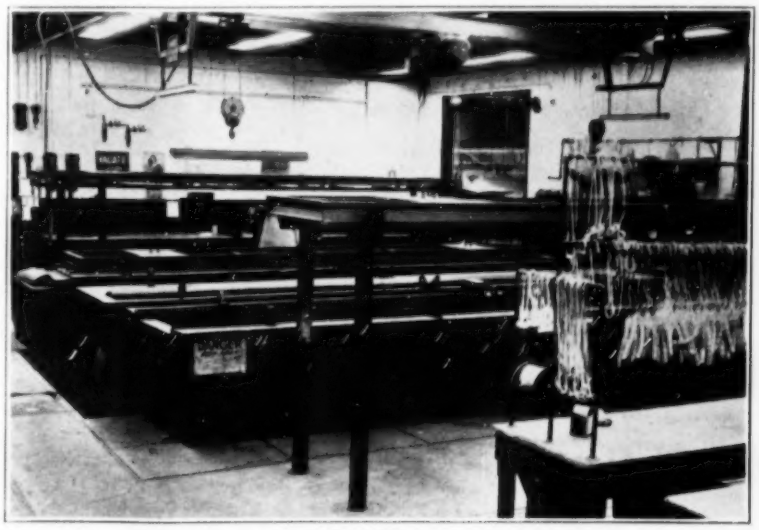


Fig. 2—PLATING ROOM of the Grumman plant
The three tanks shown are for plating, rinsing and drying operations.

1. The plating units from which the chromate wastes are derived are illustrated in Fig. 2.

The removal of the chromic acid from the rinse water allows the purified rinse water to be reused. Generally, demineralized water is employed as makeup water to eliminate other cations which would be converted by the Permutit S to the corresponding hydroxides and thus would be harmful. As the rinse water is usually hot, little heat is lost and only a relatively small amount of makeup water and heat must be added to the rinse bath.

The Permutit Q unit is regenerated with sulfuric acid after exhausting its capacity for removing metal cations (such as iron or aluminum) from the chromic acid bath or sodium from the Permutit S regenerant. The regenerant solutions from the Permutit Q go to waste after neutralization with lime.

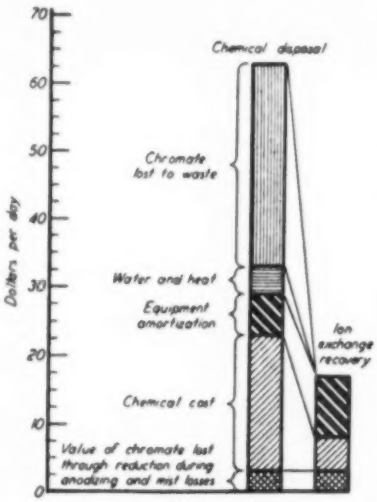


Fig. 3—OPERATING COSTS

At Grumman, chromic acid recovery cost of $17 per day includes chemicals, amortization, and resin replacement.

Cost Savings

One plant, installed well over a year ago, has demonstrated striking savings (see Fig. 3). Recovery costs of $17 per day compare with former disposal costs of $63 per day. Among savings which can be demonstrated for the chromate purification and recovery process are:

Installation costs approximately 50 per cent of the cost for installing conventional precipitation equipment.

Operating costs approximately 30 per cent of conventional costs when taking into account the value of the chromate recovered, and also the costs of water and heat.

Floor space is only 20 per cent of that required for conventional equipment.

The loss of strategic material (chrome) is only 10 per cent of that taking place in precipation methods.

The quality of product and efficiency of anodizing are intangibles, but far superior results are obtained by using ion exchange treatment.

Limitations

In applying ion exchange processes to waste treatment, several limitations should be borne in mind. The concentration of the impurities should be relatively low. Ion exchange processes show up to best advantage in dilute solutions and the more dilute, the better. The concentration of impurities should, in general, be less than one-half of one per cent (0.5%), although there are numerous applications where ion exchange might be justified even at higher concentrations of impurities.

The disposal of the regenerant is often a problem. The regenerant volume is, of course, lower than that which would exist if ion exchange were not used, but there is no point in concentrating a substance unless some method of disposing of the concentrate is available. This might take the form of selling the concentrate as a byproduct if it is variable; reworking the concentrate in the process from which it arose; hauling and lagooning the concentrate; or precipitating the concentrate to form a sludge which can then be dumped.

Finally, it must be borne in mind that certain wastes include constituents which might harm the ion exchanger either through a chemical poisoning of the active groups or otherwise destroying the active groups. Certain constituents may cause physical destruction of the resin, blocking the ion exchange bed due to suspended solids in the waste, or may coat the resin to make it ineffective.

In spite of these limitations, ion exchange has shown striking economies in the treatment of certain wastes. There is ample evidence that numerous other industries will find this new "unit operation" can help them in solving waste disposal problems, often at a profit.

Public Opinion Survey Shows Greater Demand For Fluoridation

On the basis of a poll, George Gallop recently reported that with the public becoming increasingly familiar with the idea, popular demand for the fluoridation of water supplies in cities and towns which have not adopted the program continues to mount.

By a margin of nearly 4-to-1 today, voters in these cities who know about the process would favor their communities undertaking a fluoridated water plan to control tooth decay.

An American Institute of Public Opinion study 16 months ago first revealed the widespread public acceptance of the idea.

At that time, 56% were familiar with the process and three out of every five in this group gave it their vote of approval.

Today, nearly seven out of every 10 voters, or 68%, know about the process—an increase of 12 points.

With some 600 cities and towns now putting fluorides in their water systems, the institute had its nationwide corps of interviewers put a battery of three questions to a cross section of voters.

The first was:

Have you ever heard or read anything about the use of fluoride in city water to help prevent tooth decay?

Sixty-eight out of every 100 persons questioned had heard or read about the process, while 32% had not.

Those who had heard of it were asked:

Does your community use fluoride in its water supply?

Seven per cent said their communities already had installed fluoridation equipment.

The remaining 61%, living in communities not now using fluorides in their water supplies, were then asked:

Would you favor or oppose a plan for putting fluoride in the water supplied to this community?

The vote:

Favor	36%
Oppose	10
No opinion	15
	61%

Support for fluoridation is greatest among persons who have had the most education, as the following table shows:

	College	High School	Grade School
Favor	55%	39%	22%
Oppose	13	11	9
No opinion	17	14	15
	85%	64%	46%

Design of Sewage Pumping Plants

A Practical Method of Estimating Present and Future Capacity Needs

by RAYMOND G. MARTIN, *Asst. Civil Engr., Bureau of Engineering, City of Los Angeles, Calif.*

ONE might say that the design of a sewage pumping plant is only a series of estimates. Actually it is a pyramid of estimates. Everything from the area to be drained to the final construction is based on calculated estimates.

Unfortunately engineering is not perfected to the state of being an exact science which would make the design of a pumping plant a simple mathematical problem. Published literature shows that opinions differ greatly in the methods used to arrive at these estimates.

The following discussion includes four items which must be estimated in the design of a sewage pumping plant:

1. The *design capacity* of the plant
2. The *flow rate* of the sewer system
3. The *pump capacity*
4. The *reservoir capacity*

Sewage pumping plants can be broken down into two classes: one without storage, the other with storage. The type without storage is suitable in cases where there is a large flow of sewage with a small change in rate of flow. The type with storage is suitable for any type of flow.

The methods which will be discussed are well suited for economical design of a pumping plant using storage. Also, some of these methods apply as well to a pumping plant without storage.

Design Capacity

The first thing that must be estimated is the *design capacity* of the plant. The design capacity is defined as the planned total daily flow through the plant. This capacity is based on tributary area, the limits of which are defined by the natural terrain or the sewer layout.

The flow from any given tributary area may be estimated in either of two ways:

1. Based on population;
2. Based on zoning characteristics.

The first method is best suited for residential areas, while the second method is best suited for commercial and industrial areas.

If the past and present populations are available in the Federal census, the future population can be estimated by expanding the population along a biological growth curve.

If the estimates are to be based on zoning, consideration must be given to terrain and environment. This means accounting for such features as rivers, hills, transportation, and utilities.

The basic flow units, such as G.P.D. and C.F.S. per acre, may be based on actual measurement of similar areas, such as sewer gaugings and previous pumping records, or on zoning coefficients when available. The flow to be considered should be the average of the three peak months of the year; for the Los Angeles areas these are January, February and March.

Flow Rate

Having arrived at an estimate of

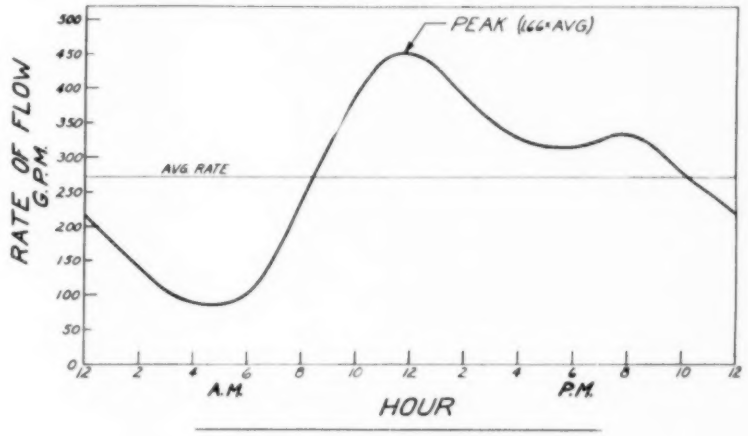


Fig. 1—RATE CURVE for sewage flow

This curve is typical of a normal rectangular residential area.

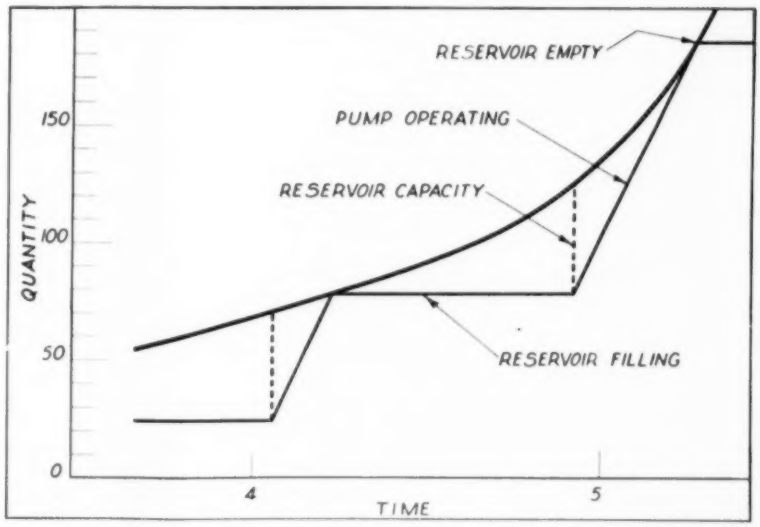


Fig. 2b—EXPANDED MASS CURVE Fig. 2a for plotting pumping frequency

Pump operates at fixed rates when reservoir is filled to capacity.

Note: This paper, presented before the Los Angeles Section of the Am. Soc. of Civil Engrs., has been released to the author for publication in *Water & Sewage Works*.

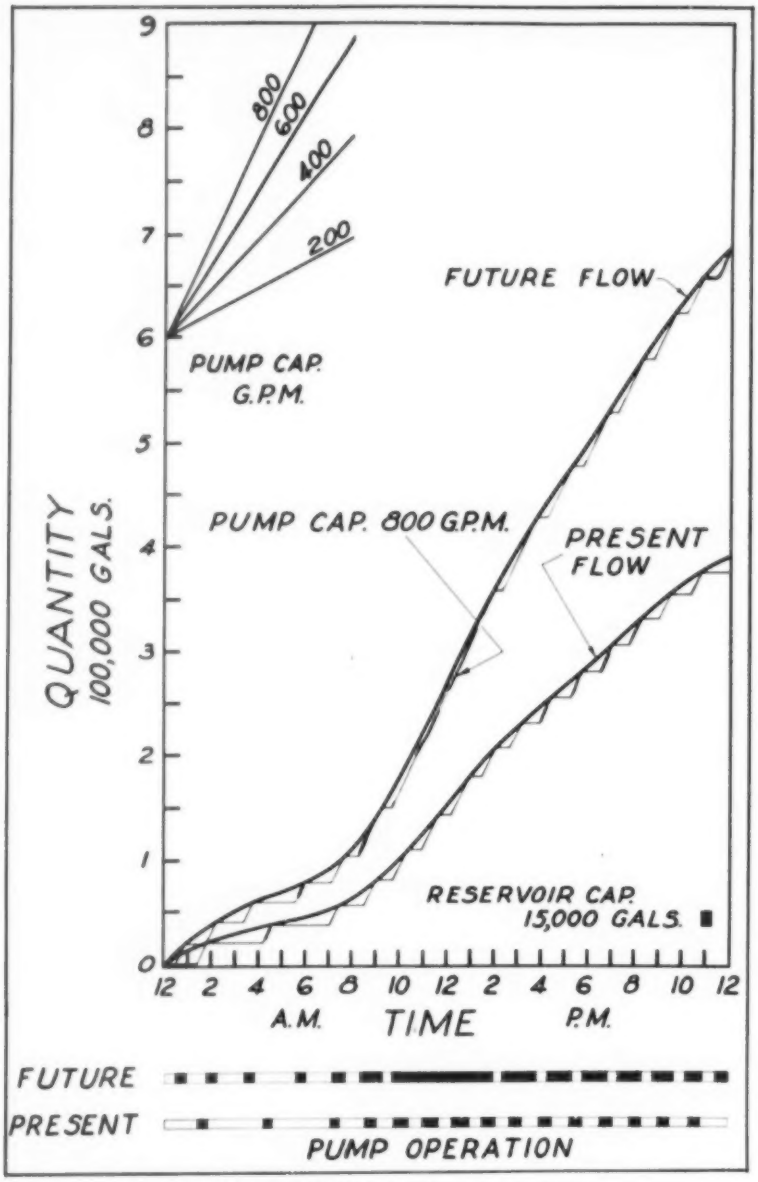


Fig. 2a—MASS DIAGRAM developed from rate curve

Slope of curves is equal to rate of flow (ten year future is 1.8 times present). Below: Solid dashes illustrate pumps in operation.

the average daily flow, it is now necessary to determine how this flow will arrive at the site of the pumping plant. The best method to do this is to draw a flow rate curve as illustrated in Fig. 1.

The flow rate curve is a curve which defines the rate of flow at any hour of the day. The average rate of flow is shown on the curve.

The curve shown here is a typical curve of a normal rectangular residential area. One extreme curve may be found in the flow from an Army camp where exaggerated peaks are found every time the bugle blows. Another extreme case is found in the flow from a 24-hour packing plant where the flow is constant at all times of the day.

The peak factor is a ratio of the average flow to the peak flow. The curve in Fig. 1 has a peak factor of 1.66. Note that the curve also shows a secondary peak in the evening. A normal curve has a peak factor varying from 1.3 to 2.2.

The rate of flow from a given area may be estimated from actual measurements, or by considering the time of concentration of the sewer system, or by comparing the given area with other areas of similar characteristics.

The future flow rate may be estimated by expanding the flow rate curve by the increase calculated in the design capacity.

Mass Diagram

Having established the flow rate both present and future, a mass curve or mass diagram can be drawn, from which both pump capacity and reservoir capacity can be estimated. The mass curve illustrated in Fig. 2a was developed from the flow rate data comprising Fig. 1.

The mass curve is defined as the accumulated inflow at the pumping plant at any hour of the day, and is derived by integrating the flow rate curve from any zero hour, in this case considered to be 12 o'clock midnight. This means that the area under the flow rate curve between zero hour and any time of the day is equal to the ordinate of the mass curve. Another way of stating this is that the mass curve defines the total amount of sewage that arrives at the pumping plant between zero hour and any specific hour of the day.

Thus the slope of the mass curve equals the rate of flow. It is these two features that make it possible to plot a picture of the operation of a pumping plant and therefore pick a good combination of pumps and reservoir capacity.

At this point I should add that it is necessary to estimate the life of the structure and pumps. A reasonable life for the structure is 40 years. However, some engineers like to use 50 and 60 years.

Authorities differ considerably on what is a reasonable life of a sewage pump. For secondary reasons, ten years will be considered the life of the pump in this example.

As you can see on the diagram (Fig 2a), there are two curves. One is the present flow, and the other is the flow ten years from now, or 1.8 times the present flow. For simplicity, this is to be considered the ultimate flow.

Pump and Reservoir Capacity

An expanded section of the mass curve, (Fig 2b*), shows how the pump operation can be plotted directly on the curve. As mentioned before, the ordinate of the curve equals the accumulated inflow. The slope of the curve equals the inflow rate. The pump capacity is the slope of the pumping line. The storage capacity is a fixed ordinate. The time is measured on the abscissa.

* Fig. 2b appears on the first page of this article. Because of the size of Fig. 2a, 2b would not fit in any position following 2a. —Ed.

Starting at a point on the mass curve, a horizontal line is drawn to the right. This represents the filling of the reservoir; it is considered full when the difference between this line and the curve equals the storage capacity, a vertical dotted line. From the point on this line where the reservoir is full, a line is drawn with a slope equal to the pump capacity. This line represents the pump in operation. At the point where this line intersects the mass curve, the pump shuts off and one cycle is complete. The picture now shows the time that the pump is idle and the time that the pump is in operation.

To help in picking a suitable pump, a series of pump capacities is drawn in the upper left hand corner of the diagram (Fig. 2a) making it easy to choose a pump capacity which closely matches the mass curve.

The example shows the plotting of pump operation for the entire day. This is done for a given storage capacity and pump capacity. If the operation is not suitable for the capacities chosen, they may be altered and the operation plotted again. This is done for both present and future curves.

If a straight line is drawn between the two end points of the mass curve, it would represent a pump capacity which would just handle the total daily flow and never shut off. However, a quick glance at the storage capacity necessary will show how impractical this combination would be.

At the bottom of the diagram you can see two dashed lines. This is done to show a clear picture of the operation. The solid area represents the pumps in operation. Thus a solid line would indicate the pump running continuously.

In this manner the pumps and reservoir are actually fitted to the sewage flow, thus making an economical design.

This method is not new, for it was used in other ways long before I was born. However, I feel that it still provides a good straightforward approach to the design of a sewage pumping plant.

Worth-while Kink

One of the worst bugbears in water works operation is the "back-handed" valve. This is the occasional valve whose direction of closure is contrary to that of the majority of valves in the system. Where there are only a very few of these valves, the simplest solution is to replace the working parts. But where there is an appreciable number of them, the cost of doing this could be prohibitive.

At least two water supply organizations have solved the problem in an ingenious manner. These are the South Pittsburgh Water Co. and the Water Department of the City of Rocky Mount, N.C. They simply replace the normal four sided operating nut on the "back-handed" valve with a five sided nut. A special key is made to fit the five sided nut, which can not be operated with the four sided key. In this way, the operator has positive knowledge of the direction of closure whenever he operates the valve. Like all good theories, this one works in practice.

(From Homer A. Beckwith, The Pitometer Co.)

Washington, D.C., Merges Water, Sewage and Sanitation in New Department

One of the major steps in the reorganization of the city government of the District of Columbia has been the merging of the District's water, sewerage and sanitation operations.

David V. Auld, former head of the city's Water Division has been made Director of the Dept. of Water and Sewage. Ralph E. Fuhrman, for a number of years Supt. of Sewage Treatment works, has been made Deputy Director of the new department. Paul Lanham will head the Division of Water Operations; Young J. Wright will head the Division of Sewer Operations; William Xanten becomes head of Division of Sanitation.

Earle B. Phelps is Dead

Esteemed Pioneer in the Sanitary Field

Professor Earle B. Phelps died suddenly at his home in Gainesville, Fla., on May 29th. He was born in Galesburg, Ill., on July 10, 1876.

After earning a degree in chemistry at the Massachusetts Institute of Techology in 1899, he became associated with the world-famous Lawrence Experiment Station. He helped organize and conduct well-known studies by the United States Public Health Service on the pollution and self-purification of the Ohio River; and served as cities' and states' consultant and expert in various capacities including preparation of court cases. He has been Associate Professor at the Massachusetts Institute of Technology; Professor of Chemistry, Hygienic Laboratory, United States Public Health Service; Consulting Sanitary Engineer for the International Joint Commission, United States-Canadian Waterways; and visiting Professor at the University of Puerto Rico. He was author of several texts on stream sanitation and public health engineering, and he had published over 60 articles in technical magazines.

He retired from the School of Public Health, College of Physicians & Surgeons, Columbia University, as Professor Emeritus of Sanitary Science. For the past eight years Professor Phelps has been teaching stream sanitation and public health engineering in the Civil Eng. Dept. University of Florida. He was also engaged as consultant and leader on a number of sanitary research projects sponsored by the Engineering and Industrial Experiment Station at the University. He is recognized as a pioneer investigator and as one of the world's greatest authorities on sewage chemistry, stream sanitation, and public health engineering.

Prof. Phelps was a charter member of the American Public Health Association. The Association in 1953 awarded him its Meeker Award in recognition of his "outstanding achievements across the years for the public health."

The funeral was held during the 21st Annual Short Course for Water and Sewage Works Operators at the University of Florida. At the suggestion of many of his friends, an "Earle B. Phelps Memorial Fund" is being formed; this will be in commemoration of the great service which Professor Phelps has rendered to mankind through his work in the field of public health engineering. The fund, to be administered by the College of Engineering, University of Florida, will be used to support scholarships or research in the further advancement of the work to which he dedicated his life.

THE EDITOR'S COMMENTS

Another "First" for Wisconsin

A new statute has just been enacted by the Wisconsin legislature which should go far toward the advancement of water and air pollution abatement by industry. Importantly, the new law should especially benefit those in the category of "small business."

Along lines advocated for some time by this magazine, herein as well as in Federal circles, for income tax purposes the Wisconsin statute permits an accelerated five year amortization of all capital costs for providing treatment plants, lands for lagoons, or any other facilities designed to curtail the pollution of water resources or the air. In addition the law importantly exempts such lands, lagoons, treatment plants and other pollution control facilities from all forms of property taxation for a like period of five years.

A previous "first" for Wisconsin is the fact that for a long time the publicly as well as privately owned water utilities of this state have operated under regulation and beneficial guidance of the State Public Service Commission. We use the term "beneficial guidance" because publicly owned water utilities and their personnel have definitely benefited from the supervisory regulation and cooperative guidance of the State Commission.

With the exception of Maine, where a similar system has operated beneficially for a number of years, we find in other areas an erroneous lack of any enthusiasm on the part of managements of publicly owned water systems for regulation in any form by the State Public Service Commission, or equivalent body. We must presume this to be due to a lack of knowledge as to how well the Wisconsin and Maine systems of regulation have served the publicly owned water utilities of these two states.

Getting back to the meaningful new Wisconsin statute (Chapter 183: Laws of 1953), designed to expedite pollution abatement through cost relief, the State Committee on Water Pollution (Theodore F. Wisniewski, Director) deserves high credit for the part it took in securing such assistance to industry saddled with profit curtailing operations incident to compliance with pollution abatement orders. A meaningful prerequisite to property tax exemption and accelerated amortization of capital investment is that stipulation in the Act which requires that operating statements covering pollution control operations be filed annually by the beneficiary.

If we correctly interpret the statute, *any* facility provided as the result of orders by state or local authorities requiring pollution curtailment comes within the Act, inclusive of investment for equipment and process changes *within* the plant proper as well as external treatment plants, lagoons, irrigation areas, and the like.

Other states and the Federal government can, with justified consideration, pay heed to the soundness of Wisconsin's new and realistic policy setting Chapter 183 of the Laws of 1953.

The Earle B. Phelps Memorial Fund

On another page in this issue appears a biographical sketch of the late Earle B. Phelps, one of those highly esteemed pioneers in the sanitary engineering field. In our book he has always rated high amongst the leaders and investigators in the field, and as a teacher of the sanitary sciences. At 77 years of age he closed his career still teaching and investigating.

Our early esteem for this man was born of a meeting in his office while engaged as Professor of Chemistry in the U.S. Public Health Service. This was about 1914 when Abel Wolman and this writer, fresh from Johns Hopkins Univ. and just cubs with the Maryland State Dept. of Health, were developing the now widely used residual chlorine method of water chlorination control. We went to Washington to learn what we might from the "great man"; and, this we did with a never to be forgotten kindliness and inspiring interest. It has been said that only truly "big men" are wont to do such things.

With great pleasure we learned that Professor Phelps had only recently received the Meeker Award from the Am. Public Health Assn. "for his outstanding achievements across the years in the interest of public health." With even greater pleasure we now learn of the establishment of "The Earle B. Phelps Memorial Fund" for scholarships, to be administered by the University of Florida's College of Engineering, where he was teaching and investigating up to the time of his death May 29, 1953.

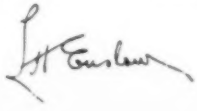
As Maine Goes . . . ? We Hope Not.

Maine has in recent years been imposing a state sales tax on water. All water utilities, publicly as well as privately owned, have been required to add the sales tax to all water bills. Such taxing of water has seemed unfair to Maine water works men.

Furthermore, they reason that it is actually the people and not the water utility who owns the water; that the water utility renders only a service in the form of taking a product that is in reality the property of the people, cleans and purifies it, transports and delivers the product to the people for their use. Actually these people are not water consumers, but water *users*. After use of the water it is returned to the water-courses, frequently for re-use by others.

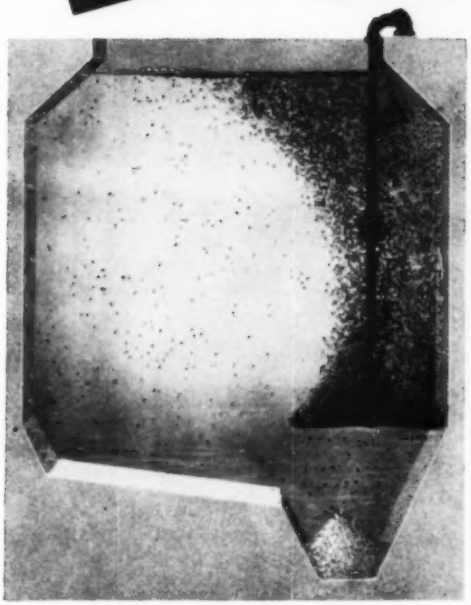
Maine water works men rightly reason the unfairness of sales taxing such a necessity as water, whereas such commodities as food, fuel, fertilizer, gasoline, tobacco and even liquor are exempt from the state sales tax. On these grounds the Maine Water Utilities Association through legislative channels has waged a fight against the tax.

Now the fight is over and the water works men of Maine have lost again. The proposed amendment exempting water from the 2% state sales tax was defeated and the tax remains. This leaves us with but one thing to say relative to the time-honored slogan—"*As Maine goes, so goes the Country*"—in this instance, let's hope not!



CHICAGO SEWAGE EQUIPMENT

AER-DEGRITTER



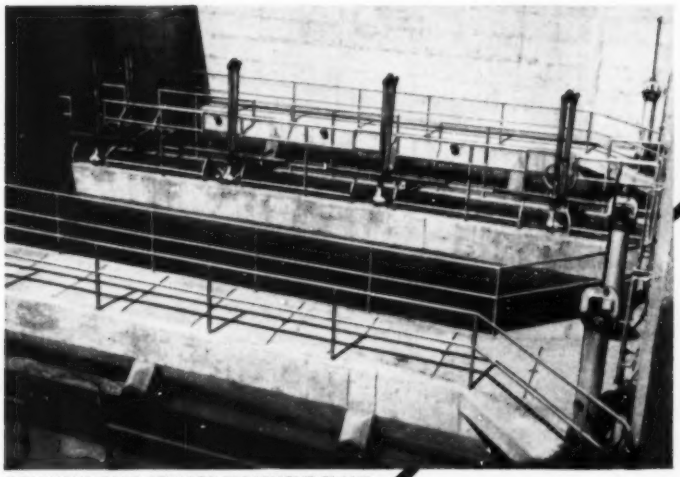
The only method of removing grit and sand from sewage without mechanical equipment is provided by the Aer-Degritter. The velocity of flow is controlled by air introduced through Swing Diffusers and Precision Diffuser Tubes. All sand of 0.2 mm. (65 mesh) and larger is washed and deposited in the bottom of the tank.

Less than 10% volatile matter and only a negligible trace of putrescible organics remains in the grit removed. Aer-Degritters may be installed ahead of all mechanical equipment because coarse sewage material will not interfere with the operation of the Aer-Degritter or affect the hydraulic design of the plant.

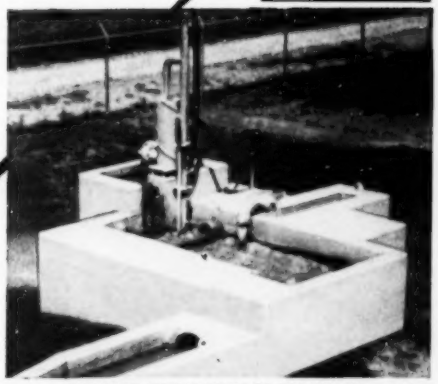
The basic features of the Aer-Degritter are:

- **MAXIMUM REMOVAL**
- **CLEAN GRIT**
- **NO MECHANISM**
- **LOW COST**
- **SIMPLE STRUCTURE**
- **AIR CONTROLLED VELOCITIES INDEPENDENT OF FLOW**

52 INSTALLED IN TWO YEARS



COLUMBUS OHIO SEWAGE TREATMENT PLANT
Design Flow 160 M.G.D.
PAUL A. UHLMANN & ASSOCIATES
Consulting Engineers



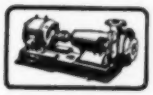
BELLAIRE, TEXAS SEWAGE TREATMENT PLANT
Design Flow .8 M.G.D.
HILTON & COULSON
Consulting Engineers

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

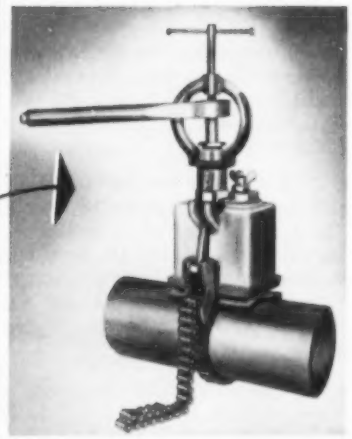
622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

Flush Kleen, Scru-Peller, Plunger. Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers.



Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

It's new... and better!



the WELSBACH *Kitson*

CORPORATION TAPPING MACHINE

For installing corporation stops under pressure, this is the safest, surest, most easily-handled and, without sacrifice of inherent strength, the lightest corporation tapping machine ever made. It is so compact that it is ideal for making taps where space is limited.

It is the new Welsbach-*Kitson* Corporation Tapping Machine—an improved model of the popular Smith-Shelly Tapping Machine, equipped now with a flat chain and adaptor that provides positive non-slip pipe-gripping action . . . which makes it an even better machine than before. And in keeping with the simplicity of operation of this popular machine, the new adaptor, which gives *positive* pipe-gripping action, is easy to set and helps speed the operation.

with the new
POSITIVE, NON-SLIP
PIPE-GRIPPING ACTION!

THE WELSBACH CORPORATION
Kitson Valve Division
1500 Walnut Street, Philadelphia 2, Pa.

Meetings Scheduled

Aug. 12—Sanford, Me.

MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Aug. 16-21—Blacksburg, Va. *(Virginia Polytechnic Institute)*

VIRGINIA WATERWORKS, SEWAGE & INDUSTRIAL WASTES SHORT SCHOOL. Sponsored by V.P.I. and Virginia State Health Dept.

Aug. 24-26—State College Pa. *(College Dormitories)*

PENNSYLVANIA WATER WORKS OPERATORS ASSN. Sec'y, R. R. Kountz, Penna. State College, State College, Pa.

Aug. 26-28—State College, Pa. *(College Dormitories)*

PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN. Sec'y, B. S. Bush, Dept. of Health, Kirby Health Center, Wilket-Barre, Pa.

Sept. 1-5, Winnipeg, Can. *(Royal Alexandria)*

MINNESOTA SECTION A.W.W.A. Sec'y, L. N. Thompson, Water Department, St. Paul 2, Minn.

Sept. 2-4—Ames, Ia. *(Iowa State College)*

IOWA SEWAGE WORKS ASSOCIATION. Sec'y, Leo Holtkamp, P.O. Box 310, Webster, Ia.

Sept. 2-3—Morgantown, W.Va. *(Hotel Morgan)*

WEST VIRGINIA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, G. O. Fortney, State Dept. of Health, Charleston, W.Va.

Sept. 3-4—Morgantown, W.Va. *(Hotel Morgan)*

WEST VIRGINIA SECTION A.W.W.A. Sec'y, H. K. Gidley, State Dept. of Health, Charleston 5, W.Va.

Sept. 3-4—Escanaba, Mich. *(Hotel Not Selected)*

MICHIGAN SECTION A.W.W.A. Sec'y, T. L. Vander Velde, State Dept. of Health, Lansing, Mich.

Sept. 9-11—Lake Placid, N.Y. *(Lake Placid Club)*

NEW YORK SECTION, A.W.W.A. Act. Sec'y, Kimball Blanchard, 50 West 50 St., New York, N.Y.

Sept. 10-11—Cleveland, O. *(Hotel Cleveland)*

OHIO SECTION A.W.W.A. Sec'y, M. E. Druley, Dayton Power & Light Co., Wilmington, Ohio.

Sept. 21-23—Owensboro, Ky. *(Owensboro Hotel)*

KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSOCIATION. Sec'y, R. Paul Farrell, 420 Sixth Ave., N., Nashville 3, Tenn.

Sept. 21-23—Owensboro, Ky. *(Owensboro Hotel)*

KENTUCKY-TENNESSEE SECTION A.W.W.A. Sec'y, J. W. Finney, 420 6th Ave. N., Nashville, Tenn.

(Continued on 80A)

engineered instrumentation *helps fight stream pollution*

PLAN FLOW INSTRUMENTATION FOR THE FUTURE
—by selecting the Brown Evenly Graduated Flow Meter. This instrument provides accurate measurement at fractional-scale readings—gives full precision when your plant is running at part load, and after it has grown to final capacity.

WHEREVER your waste treatment plant needs to measure and totalize flow—of plant influents, effluents, filter backwash water, gas, carbon dioxide, and numerous other fluids—you'll find the Brown Evenly Graduated Flow Meter the ideal solution to your problems.

Its linear scale and chart are uniformly accurate and readable across the entire range . . . are free from the difficulties of reading compressed markings near the zero point. Built-in electronic integration adds up total flow accurately for convenience in flow cost accounting and process analysis. The instrument is supplied as an electric type for remote recording, or as a mechanical meter with direct-coupled meter body.

The Brown Flow Meter embodies simple, rugged construction in every detail. The meter body is corrosion resistant, light-weight and sturdy. And to assure you of continuous performance, Honeywell's widespread organization offers prompt, experienced service.

Your local Honeywell engineering representative will be glad to discuss your plant's instrumentation requirements with you and your consulting engineer . . . to apply the experience which Honeywell has gained through years of work in this field. Call him today . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4575 Wayne Ave., Philadelphia 44, Pa.

● **REFERENCE DATA: Write for Catalog 2300, "Evenly Graduated Flow Meters"**

MINNEAPOLIS **Honeywell**
BROWN INSTRUMENTS
First in Controls

NEW IMPROVEMENTS
Cable Drum Clutch
Upper Arch Sheave
Automatic Cable Level Wind

OK CHAMPION Power Sewer Cleaner

Twin rigs take debris from sewer to street in one operation.
Mounted on four wheel trucks—safer—eliminates lifting over or pulling away from manholes—safer tandem towing.
All Controls at Working End—keeps operator out of passing traffic—allows full vision of work.
Built-in Gear Reduction Ratio—allows better use of power for bucket travel.
Fully Automatic Safety Clutch—instant acting—avoids damage to tiles and machines.

Rely on the pioneer manufacturer of power sewer cleaners.

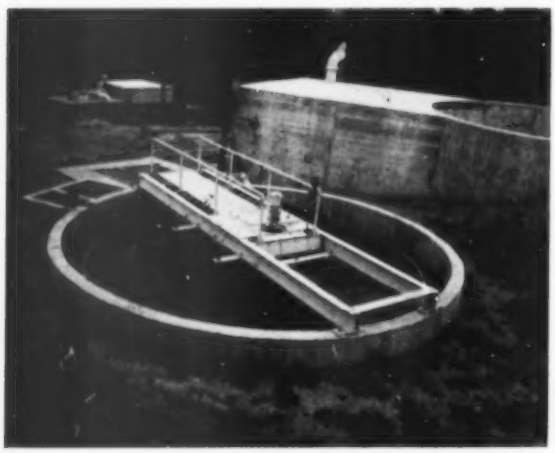
CHAMPION CORPORATION
Hammond, Indiana

SEND FOR LITERATURE

Champion Corporation, 4700 Sheffield Ave., Hammond, Indiana
Please send information on new OK Champion Power Sewer Cleaners.

Name.....Title.....

Address.....



EXCELLENT ACTUAL DETENTION

is why Spiraflo Clarifiers and Spiragesters give high removals of B.O.D. and S.S.

70 to 90% actual detention of the theoretical results in 70 to 90% removals of the S.S. by primary SPIRAFLO clarifiers without the use of pre-aeration or the use of chemicals. Can you beat it?

Write for Spiraflo bulletins 122 and 122-A and the Spiragester bulletin 124

LAKESIDE ENGINEERING CORPORATION

222 West Adams St. - - Chicago 6, Ill.

Sept. 21—Santa Fe, N.M. *(Hotel La Fonda)*
ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION. Sec'y, C. E. Harness, 271 City & County Bldg., Denver, Colo.

Sept. 22-23—Santa Fe, N.M. *(Hotel La Fonda)*
ROCKY MOUNTAIN SECTION A.W.W.A. Sec'y, George J. Turre, Board of Water Commissioners, P.O. Box 600, Denver, Colo.

Sept. 22-24—Milwaukee, Wis. *(Hotel Pfister)*
WISCONSIN SECTION A.W.W.A. Sec'y, L. A. Smith, City Hall, Madison 3, Wis.

Sept. 22-24—Rapid City, S.D. *(Alex Johnson Hotel)*
SOUTH DAKOTA WATER & SEWAGE WORKS CONFERENCE. Sec'y, Charles E. Carl, State Dept. of Health, Pierre, S.D.

Sept. 23-25—Edmonton, Alberta *(Macdonald Hotel)*
WESTERN CANADA WATER & SEWAGE CONFERENCE. (Operators' School Sept. 23) Sec'y, W. J. Waddell, 617-7th Ave. East. Calgary, Alberta.

Sept. 27-29—Excelsior Springs, Mo. *(Elms Hotel)*
MISSOURI SECTION A.W.W.A. Sec'y, Warren A. Kramer, State Office Building, Jefferson City, Mo.

Sept. 27-29—Excelsior Springs, Mo. *(Elms Hotel)*
MISSOURI WATER & SEWAGE CONFERENCE. Sec'y, Warren A. Kramer, State Office Bldg., Jefferson City, Mo.

Sept. 28-30—Poland Spring, Me. *(Poland Spr. House)*
NEW ENGLAND WATER WORKS ASSOCIATION (72nd Annual Convention). Sec'y, Jos. C. Knox, 73 Tremont St., Boston, Mass.

Oct. 4-6—Jackson, Miss. *(Hotel Heidelberg)*
ALABAMA-MISSISSIPPI SECTION A.W.W.A. Sec'y, Chas. W. White, State Dept. Health, 537 Dexter Ave., Montgomery, Ala.

Oct. 11-13—Miami, Fla. *(Hotel McAllister)*
FLORIDA SECTION A.W.W.A. Sec'y, William W. Aultman, Dept. of Water & Power, Box 316, Coconut Grove Sta., Miami 33, Fla.

Oct. 13-16—Miami, Fla. *(Municipal Auditorium)*
FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSN. (26th Annual Meeting). Exec. Sec'y, W. H. Wisely, 325 Illinois Bldg., Champaign, Ill.
(joint meeting with)
FLORIDA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, D. P. Schiesswohl, P.O. Box 210, Jacksonville, Fla.

Oct. 14—Rumsford, Me.
MAINE WATER UTILITIES ASSOCIATION (Annual Meeting). Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

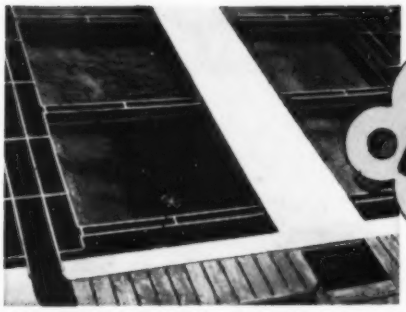
Oct. 14-16—Waterloo, Iowa *(Hotel Russell Lamson)*
IOWA SECTION A.W.W.A. Sec'y, H. V. Pederson, Municipal Bldg., Marshalltown, Iowa.

Oct. 18-21—Houston, Tex. *(Rice Hotel)*
SOUTHWEST SECTION A.W.W.A. Sec'y, L. A. Jackson, Robinson Auditorium, Little Rock, Ark.

Oct. 19-24—New York, N.Y. *(Eng. Societies Bldg.)*
AMERICAN SOCIETY OF CIVIL ENGINEERS (Annual Meeting). Sec'y, Wm. N. Carey, 33 W. 29 Street, New York 18, N.Y.

(Continued on 82A)

4 KEYS TO BETTER WATER

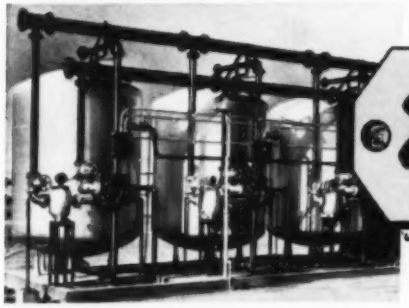


1. PRECIPITATORS

PROBLEM: Turbidity, Color, Hardness, Iron, Alkalinity

PRECIPITATORS remove dirt, color, hardness, iron, alkalinity, silica, fluorides, taste, odor by coagulation, precipitation, and settling. Fully utilize the Permutit sludge-blanket principle for big savings in space . . . chemicals . . . time!

Horizontal or vertical designs of any capacity. Tailor-made units to *triple* capacities of old-fashioned settling basins.

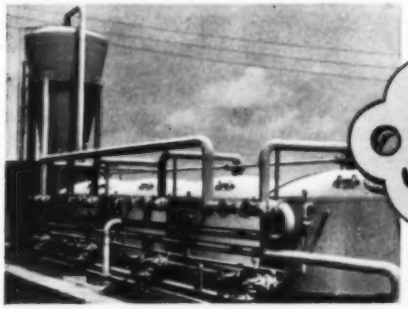


2. SOFTENERS

PROBLEM: Hardness with Some Iron, Manganese

SOFTENERS quickly reduce hardness to zero . . . while removing troublesome iron and manganese. Simplest method. Gives positive results with no waste disposal problem. Features ease of operation, low installation and operating costs.

Pressure or gravity units or batteries—any capacity. Permutit automatic controls give uninterrupted supply of softened water, save operator's time, increase efficiency of old plants.



3. SPIRACTORS®

PROBLEM: Hard, Clear Water

SPIRACTORS soften on new principle—*catalytic precipitation.* Hard water and lime-soda swirl upward through catalyst granules. Precipitates deposit by accretion, fall to bottom, are easily disposed of. Water at top is soft, clear, ready for filtration. *Total reaction time is eight minutes.* Lime treatment with no bulky sludge disposal problem.

4. FILTERS

PROBLEM: Traces of Dirt, Oil, Iron

FILTERS trap the last traces of suspended impurities, deliver a crystal-clear effluent. Permutit rapid sand filters are available in vertical or horizontal steel shells, and gravity types in wood or concrete. These units feature Permutit automatic controls. Wash, rewash and return to service—with no operator present!

FREE WATER ANALYSIS! Write today for free bulletins on these or any other water conditioning processes. Permutit will analyze your water supply, make recommendations without obligation. THE PERMUTIT COMPANY, Dept. W-7, 330 West 42nd Street, New York 36, N. Y.

PERMUTIT®

WATER CONDITIONING HEADQUARTERS FOR OVER 40 YEARS

Oct. 20-23—Atlantic City, N.J. *(Chalfonte Hotel)*
PENNSYLVANIA WATER WORKS ASSOCIATION. Sec'y, W. A. Kufs, 510 Telegraph Bldg., Harrisburg, Pa.

Oct. 22-24—Atlantic City, N.J. *(Madison Hotel)*
NEW JERSEY SECTION A.W.W.A. Sec'y, C. B. Tygert, Box 178, Newark 1, N.J.

Oct. 26-29—New Orleans, La. *(Roosevelt Hotel)*
AMERICAN PUBLIC WORKS ASSOCIATION. Exec. Sec'y, Donald F. Herrick, 1313 East 60th St., Chicago, Ill.

Oct. 27-30—San Francisco, Calif. *(Palace Hotel)*
CALIFORNIA SECTION A.W.W.A. Sec'y, J. C. Luthin, 1113 Laurent St., Santa Cruz, Calif.

Oct. 28-30—Wilmington, Del. *(Hotel DuPont)*
CHESAPEAKE SECTION A.W.W.A. Sec'y, C. J. Lauter, 6955 33rd Street, Washington 15, D.C.

Nov. 4-6—Roanoke, Va. *(Hotel Roanoke)*
VIRGINIA SECTION A.W.W.A. Sec'y, W. H. Shewbridge, 708 State Office Bldg., Richmond 19, Va.

Nov. 5—East Providence, R.I. *(Wannamoisette Country Club)*
NEW ENGLAND SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Stephen M. Hurley, Jr., 331 State Office Bldg., Providence, R.I.

Nov. 9-11—High Point, N.C. *(Sheraton Hotel)*
NORTH CAROLINA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

Nov. 9-11—High Point, N.C. *(Sheraton Hotel)*
NORTH CAROLINA SECTION A.W.W.A. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N.C.

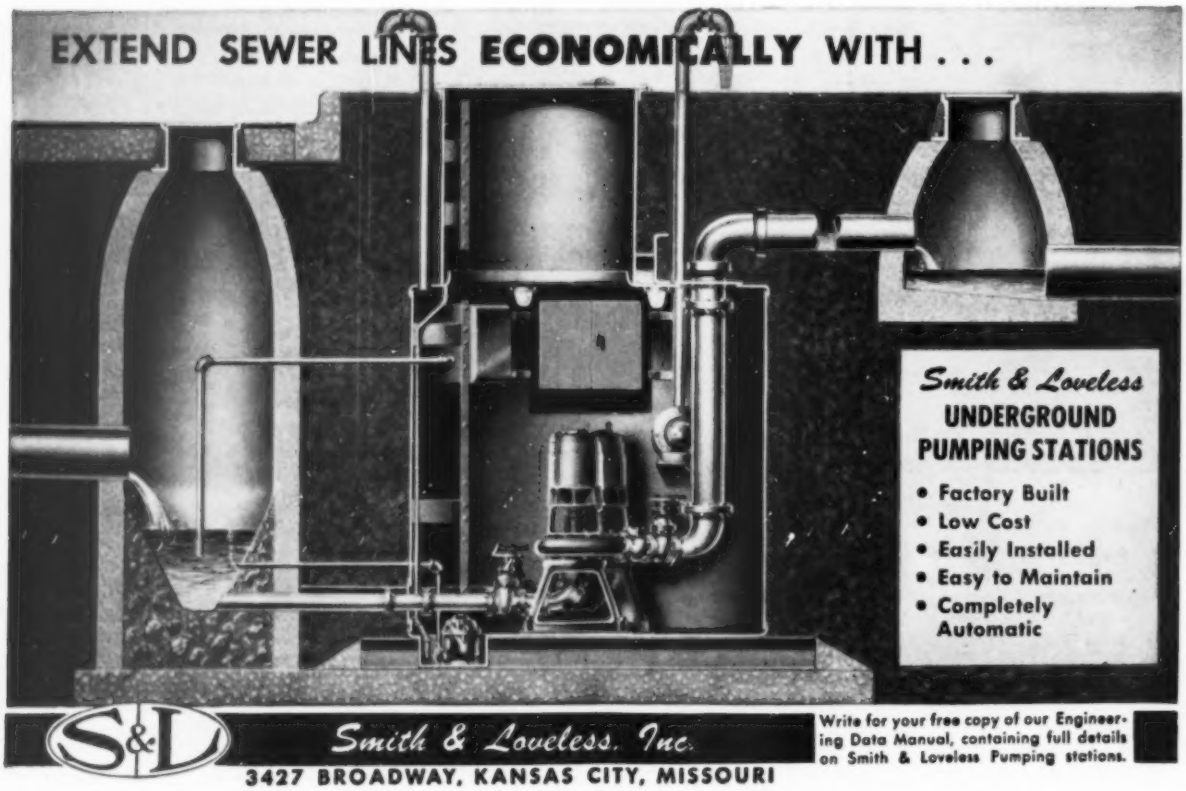
Nov. 12-13—Lincoln, Neb. *(Hotel Capitol)*
NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSOCIATION. Sec'y, Paul W. Mousel, 602 W. B. Street, McCook, Neb.

Nov. 18-23—New York, N.Y. *(Statler & New Yorker)*
AMERICAN PUBLIC HEALTH ASSOCIATION. Sec'y, Mrs. W. R. Walsh, A.P.H.A., 1790 Broadway, New York, N.Y.

Nov. 16-20—Stillwater, Okla. *(Okla. A. & M. College)*
OKLAHOMA WATER, SEWAGE & IND. WASTES SHORT COURSE. Sec'y, H. J. Darcey, State Dept. of Health, Oklahoma City, Okla.

Dec. 9—Waterville, Me.
MAINE WATER UTILITIES ASSOCIATION. Sec'y, Earle A. Tarr, 15 Bowdoin St., Winthrop, Me.

Dec. 13-16—St. Louis, Mo.
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. (Annual Meeting). Sec'y, F. G. Van Antwerpen, 120 East 41st St., New York 17, N.Y.


EXTEND SEWER LINES ECONOMICALLY WITH . . .
Smith & Loveless
UNDERGROUND PUMPING STATIONS
• Factory Built
• Low Cost
• Easily Installed
• Easy to Maintain
• Completely Automatic
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Write for your free copy of our Engineering Data Manual, containing full details on Smith & Loveless Pumping stations.

LOUISVILLE
LEARNED FROM EXPERIENCE

C-P-P* meets the BIG 3 REQUIREMENTS

The Louisville Water Company picked Concrete Pressure Pipe for a new four-mile, 60-inch line because they want *Sustained High Carrying Capacity.*

Their decision was based on *experience* . . . their own.

While planning this line, they checked on the carrying capacity of earlier Louisville pipe . . . found two supply lines laid within two years of each other some twenty years ago . . . one concrete, the other not.

The concrete line's capacity is now 530,000 gallons-per-day more than when it was laid ("c" value *increased* from 145 to 149). The other line's capacity is 5,480,000 *less* ("c" value is down from 135 to 94).

That's the story in a nutshell, but . . .

This is only one of the reasons why the Louisville Water Company picked Price Pipe. Louisville has other reasons. Price Pipe's *long life,* for example. With Concrete Pressure Pipe, only concrete is exposed . . . and when buried in the ground, concrete is ageless as limestone . . . its life is measured in centuries.

And Louisville likes the *high strength* of Price Pipe. They know it's safe from external loads . . . that sudden and complete failure is all but impossible.

Finally, they like the *economy* of Price Pipe . . . for it gives them "Longest trouble free service at lowest cost" . . . because of its sustained capacity, long life and high strength, and because it is easy to lay, easy to tap, and easy to maintain.

Send for the facts on Price Pipe. Learn how your water lines can have long life, great strength *and* sustained high carrying capacity. Mail the coupon today.

* only CONCRETE PRESSURE PIPE MEETS THE **BIG 3** REQUIREMENTS

1 Long Life
2 Great Strength
3 Sustained Capacity

PRICE Pressure PIPE
PRESTRESSED CONCRETE
STEEL-CYLINDER PIPE

Price Brothers Company

1816 East Monument Avenue, Dayton 1, Ohio

Please send me, without obligation, the following literature:

- ☐ Check Sheet of Water Line Requirements
- ☐ Facts on Prestressed Pipe
- ☐ Price Pipe for Pressure Sewer Lines

Name_____
Title_____
Organization_____
Address_____

Pickups from Purdue's "Sanitary Engineering News"

Don E. Bloodgood, Editor

Mr. Byrnes, Representative from Wis., has introduced a bill in the 83rd Congress which would permit accelerated amortization of industrial waste treatment works.

* * *

Utility	Accident Frequency Rate
Communications	2.05
Electrical	11.96
Gas	16.03
Water	25.50

* * *

The small water plant is at least six times as dangerous, from the standpoint of accidents, as the average of all other industries.

* * *

Tannic acid in concentrations in excess of 0.01% will inhibit the growth of sulphate-reducing bacteria. It is believed that tannates have been the inhibitors that prevented rusting of ancient iron relics.

* * *

Fairbanks, Alaska, spends about $20,000 thawing frozen water lines each year.

Portsmouth, Va., Reports "The Best Fluoridator"

A recent drought in the Portsmouth area supplied X. D. Murden with what he claims is the best fluoridator on the market.

When one of the wells, which is a source of water supply for Portsmouth, went dry another well was drilled to a depth of 573 feet and when the water was tested it was found to contain five parts per million fluoride. When this water is mixed with the effluent from their two filter plants they get the desired fluoride content of one part per million. Since the city had just decided to fluoridate X. D. feels that he is away ahead of the game.

(The above item is from the *News Letter* of the Virginia Section, A.W.W.A. Mr. Murden is the Section's Director in the national association. If you are curious, the "X" is for Xenophon; what the "D" is for we do not know.)

Waste Treatment Project Sets Good Example

Community and Industry Cooperation

Additions to the sewage plant of the town of Ayer, Mass., were recently placed in operation for treatment of tannery wastes. Participating in the dedication ceremonies were town, city, state and federal officials, health and water pollution control authorities and representatives of various New England industries concerned with industrial waste problems.

The new works will treat the wastes of the Hartnett Tanning Company which previously were discharged into a tributary of the Nashua River. A new primary settling tank is provided for the tannery wastes and the settled wastes mix with the settled domestic sewage for further treatment on the existing trickling filters. An additional secondary settling tank and new sludge beds have been provided.

The completion of these works is the result of a cooperative project by the town of Ayer and the Hartnett Tanning Company to solve a mutual pollution control problem. Under the agreement, the additions to the sewage treatment plant and the force main from the tannery were financed

water
is important to everybody...

The Miss at this fountain of youth would be mighty disappointed if low water pressure were suddenly to deprive her of a drink—and so would millions of others who take water pressure for granted. One of the best, and least expensive ways to assure the constant flow of water is through Centrilining.

The Centriline process thoroughly cleans and centrifugally applies cement-mortar to the interior of pipe lines in place—prevents corrosion, tuberculation and leakage; minimizes interruption of line operation and street traffic. For an effective, economical means of increasing flow capacity, look to Centriline.

Write for free booklet today.

CEMENT-MORTAR LININGS FOR PIPES IN PLACE

3,000,000 FEET OF EXPERIENCE

CENTRILINE CORPORATION

A subsidiary of Raymond Concrete Pile Co.

140 CEDAR STREET, NEW YORK 6, N. Y.

Branch Offices in Principal Cities of United States and Latin America

CORROSIVES CAN'T DESTROY

TYLOX

SEWERAGE AND DRAINAGE PIPE JOINTS

Regardless of the type of waste to be carried in the disposal lines you are designing, you can count on pipe joints that are permanently *safe* from corrosion, when flexible rubber Tylox Jointing Gaskets are specified.

Two important factors make Tylox Gaskets immune to attack by corrosion. First, Tylox is made of a specially compounded rubber which is resistant to the acids and alkalies commonly found in sewage and industrial wastes. Second, the mechanical nature of the joint itself protects the Gasket from contact with corrosion. When the pipe is shoved home, *flexible* Tylox "packs" the joint's annular space under *compression*. At the same time, the tongue-and-groove (or bell-and-spigot) of the pipe encloses the Gasket so completely that no appreciable part of it is exposed to the wastes in the line.

When a Tylox Gasket is thus *enclosed* and *compressed*, and buried under ground, it is protected from oxidation. It *stays* flexible and is virtually ageless.

You can safeguard the critical joints of *your* sewerage and drainage pipe projects by specifying Tylox Jointing Gaskets. Tylox defeats corrosion and keeps the joint permanently tight, preventing leaks and root penetration for "the life of the line."

Write today for complete specification data and literature on Tylox Pipe Jointing Gaskets.

1789

HAMILTON KENT
MANUFACTURING COMPANY
KENT, OHIO

225 Gougler Ave. **Tel. 3449**

REXON COATING NO. 2 PROTECTS SEWER AND DRAIN PIPE WHERE CORROSION IS EXTREME . . .

Concrete pipe safely handles corrosives in 90 percent or more of sewerage and drainage installations. For installations where corrosion is extreme, such as those disposing of certain industrial wastes, or where the line will run through unusually corrosive soils, REXON Coating No. 2 provides additional protection for the pipe, both inside and out. REXON is self-vulcanizing and resistant to virtually all acids, alkalies, oils, greases and solvents. It is easily and quickly applied by brushing or spraying on the pipe.

by the town at a cost of $233,000 and the company will reimburse the town $145,000 over a 10-year period. In addition, the company has constructed on its premises a $50,000 pumping station as part of the entire waste treatment construction project.

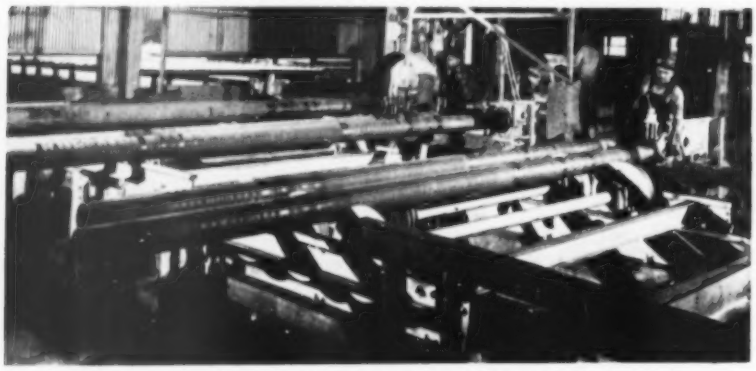
Engineer Board to Serve Raritan Valley System

Wolman, Mohlman and Chase Appointed

The appointment of a board of consulting engineers to advise the Middlesex County Sewerage Authority in the construction of a $22,500,000 Raritan Valley trunk sewer system was recently announced by Chester A. Lydecker, New Brunswick, N. J., authority chairman.

Named to the board were Dr. Abel Wolman of Johns Hopkins University; Dr. Floyd W. Mohlman, chief chemist and director of laboratories for the Sanitary District of Chicago, and Dr. E. Sherman Chase of the firm of Metcalf & Eddy of Boston.

Mr. Lydecker said the board would coordinate, check and analyze both scientific data and plans for the trunk sewer system. Of twenty-one eligible participants, eleven have approved contracts, Mr. Lydecker reported.



Centrifugal cement-lining machine in operation at a McWane-Pacific pipe plant.

McWANE-PACIFIC
Cement-Lined CAST IRON PIPE
MAINTAINS FLOW

McWane-Pacific Super-DeLavaud Cast Iron Pipe and Pipe Fittings are furnished with either standard thickness of cement lining or thin cement lining with seal coat, when so specified. The cement lining is applied centrifugally in standard Super-DeLavaud cast iron pipe, either open bell-and-spigot, or Precalked Mechanical Joint.

For those sections of the country where soft water may cause interior tuberculation, cement lining protects the pipe from tuberculation and maintains a high coefficient of flow over a long period of time.

McWane-Pacific cement linings adhere strongly to the interior wall of the pipe. The pipe may be cut and tapped without damage to the cement lining. For complete information, write or telephone—

McWANE Cast Iron Pipe Company
Birmingham, Ala.
Pipe Sizes 2" thru 12"

Sales Offices

Birmingham 2, Ala.	P. O. Box 2601
Chicago 1, Ill.	333 North Michigan Ave.
New York 4, N.Y.	80 Broad Street
Kansas City 6, Mo.	1006 Grand Avenue
Dallas, Texas	1501 Mercantile Bk. Bldg.

PACIFIC STATES Cast Iron Pipe Co.
Provo, Utah
Pipe Sizes 2" thru 24"

Sales Offices

Provo, Utah	P. O. Box 18
Denver 2, Colo.	1921 Blake Street
Los Angeles 48, Cal.	6399 Wilshire Blvd.
San Francisco 4, Cal.	235 Montgomery St.
Portland 4, Oreg.	501 Portland Trust Bldg.
Salt Lake City	Waterworks Equip't. Co.
Seattle, Wash.	Smith Tower Bldg.

THEY SAY, its proof positive that when they get through treating our water its the purest in the world.

Ruined Ball Bearings Can Be Repaired*

The writer finds that many users of ball bearings are unaware of the fact that ruined ball bearings can often be repaired. For example, a letter was received not long ago in which it was stated that "the keeper of the balls" went to pieces. The letter stated that the bearing was a rather large one costing about $30 and the question was asked, "Can it be reconditioned?"

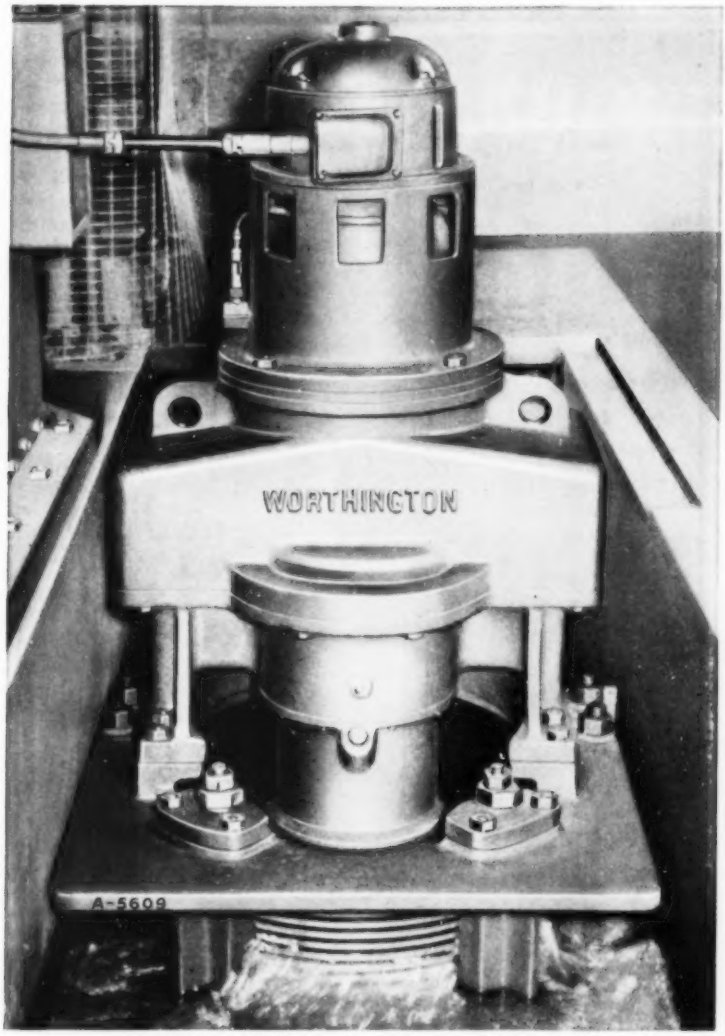
Yes. This writer did not see the ruined bearing, but its repair sounded simple as it appeared that only the retainer needed replacing. This is not difficult for a specialist in ball bearing repairs. For some reason or other, unknown to the writer, very little has been said in our publications about the fact that ball bearings can be rebuilt, and, in many instances the rebuilt bearings have proven superior to the new bearings. Balls are replaced with new ones. Rings are reground—or replaced if necessary. And so on. Here is an economy that is often well worth while.

*Contributed by W. F. Schophorst, M.E., Newark, N.J.

Denver Water System to be Surveyed by Alvord, Burdick & Howson

The Chicago firm of Alvord, Burdick & Howson has been retained to make the most far-reaching and complete examination and analysis of the Denver water system ever attempted, the board of water commissioners announced recently.

Worthington comminutor replaces mechanically raked screen at Camp Kilmer



WORTHINGTON 25C6 COMMINUTOR installed in existing 3 ft. wide by-pass channel at Camp Kilmer, N. J. The average daily flow is 3.5 million gallons. Maximum daily flow is 7 million gallons. Sanitary Engineer is C. J. Shepherd.

Comminutor installed in existing channel in five hours

During recent improvements in the sewage treatment plant at Camp Kilmer, New Jersey, a Worthington 25C6 comminutor was installed in an existing by-pass channel.

The comminutor, set up and operating in five hours, replaced a bulky, mechanically raked screen which required separate handling and disposal of sewage solids.

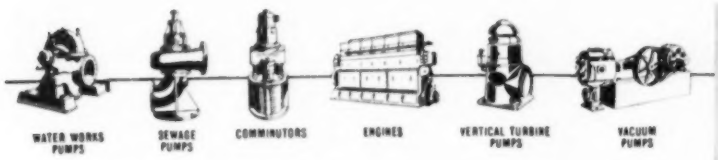
Refuse and sewage solids are now treated by a compact screening and comminuting mechanism which eliminates the health hazard caused by separate handling of solids.

Engineers everywhere recommend the completely automatic Worthington comminutor because:

- It can be readily installed in new or existing straight-flow rectangular channels.
- Cutter-racks are quickly removable for sharpening or replacement.
- It may be flooded without damage because of mercury-seal protection.

Let us work with you on your community's screening problem—or any other engineering problems involving sewage, water works, or municipal power generation. Write to Worthington Corporation, Public Works Division, Harrison, N. J.

W.2.6



All Major Public Works Equipment Under One Responsibility

WORTHINGTON

Public Works Equipment

The study, expected to be completed in about four months, is the first by an outside engineering firm since 1935 and is designed to be an "audit" of present Denver water procedures and future plans.

Similar but less extensive studies of the city water setup were made in 1922, 1928 and 1935.

By the end of 1954, the Water Board expects to have completed a $30 million expansion program which started in 1947. Even so, with the metropolitan area growing at the rate of 5 per cent per year, Denver is faced with further necessary water plant expansion.

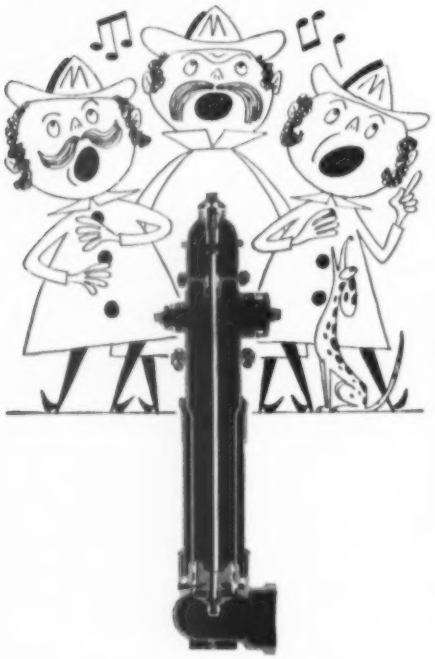
Waste Liquor Recovery from Sulfite Mills by New Process

A process for the recovery of waste liquors from pulp mills, which will help decrease stream pollution in the United States and in Canada was described at a joint meeting of the American Institute of Chemical Engineers and the Chemical Institute of Canada being held in the Royal York Hotel, Toronto, Canada. The Sulfox process (derived from sulfur oxidation), described by two chemical Engineers from New York, Arthur Pollak and Robert S. Aries, is said to adapt to the sulfite pulp mills a method which has been successfully used in sulfate (kraft) mills for a long time—burning the liquor and reusing the chemicals involved. The process can also be applied to neutral sulfite pulping, a method of pulping hardwoods which is rapidly coming into wide use.

There are about 60 mills in Canada and the United States that now dump their spent liquor. For these the Sulfox process appears to offer a practical solution to waste disposal problems. In the new process the spent liquor is evaporated and burned to an ash in the same kind of equipment now used in kraft mills. This is practical because common soda is used in place of lime, dolomite, magnesia or ammonia now used in sulfite mills everywhere.

As in kraft mills the ash from burning sulfite spent liquor is a mixture of sodium sulfide and carbonate. The sulfide is oxidized to sulfite by a procedure which the inventors have been able to reduce to a surprisingly simple operation. The product is a powder of mixed sodium sulfite and carbonate. This is fortified with sulfur dioxide in the equipment already available at all sulfite pulp mills. Any soda lost in the cycle is also added and the result is then the cooking liquor ready for the pulp mill.

Installed in Grandfather's Day— Still Providing Full Community Protection



MATHEWS HYDRANTS

Made by R. D. Wood Company

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of "Sand-Spun" Pipe (centrifugally cast in sand molds) and R. D. Wood Gate Valves

• Mathews Hydrants are built to last. They are so simple and well constructed that there's virtually nothing to go wrong.

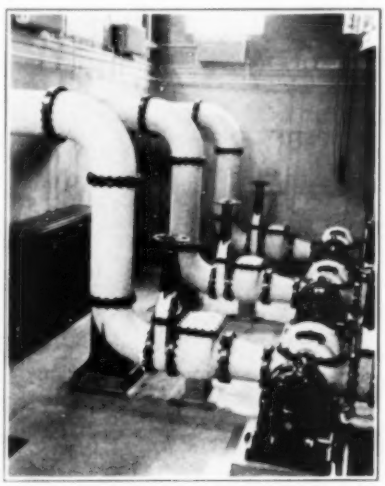
• Maintenance is easy, too. Operating thread can be lubricated during spring and fall inspections.

• When the time comes to modernize, it is a simple matter to remove the old barrel and replace it with a modern one. The job is done in a few minutes without digging or breaking the pavement.

No Other Hydrant Offers So Many Essential Features

Compression type valve prevents flooding • Head turns 360° • Replaceable head • Nozzle sections easily changed • Nozzle sections easily raised or lowered without excavating • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • Operating thread only part to be lubricated • All working parts contained in removable barrel • A modern barrel makes an old Mathews good as new • Available with mechanical-joint pipe connections

150th anniversary



Neat! Also Effective

This picture taken by Dewey Johnson of the Cast Iron Pipe Research Assn. reveals the neat appearance of the pump room at the Bloomington (Ill.) Sewage Treatment Plant. The effect results from the jacket of anti-sweat compound applied to the cast-iron pipes and pumps and the contrasting black trim.

A letter from George L. Hall,

SPECIFY RODNEY HUNT

FOR SLUICE GATES

Standard Sizes: 6″ to 108″ diameter
Larger Rectangular Sizes
for Special Installations

Versatility plus! With new equipment and enlarged facilities, we can meet your specification and delivery requirements for cast iron bronze-mounted sluice gates. Specify exactly the right gate from twelve standard types . . . over 2000 combinations of types and sizes! Rodney Hunt sluice gates are the product of skilled foundry practice, precision finishing, and carefully engineered construction: they resist deflection and assure dependable, low-maintenance operation.

Free! 232-page color catalog

This is one of the most complete works in the field. It contains photographs, drawings, specifications and complete descriptions of our sluice gates, timber gates, hoists, valves, racks and rakes, plus a valuable 28-page section of engineering data on hydraulic problems.

This important catalog was especially prepared and edited for consulting engineers, contractors and other executives who are *actively* engaged in the water control field. Please write on your letterhead for Catalog WCA-952. Rodney Hunt Machine Co., 34 Lake St., Orange, Mass., U.S.A.

RODNEY HUNT

Water Control Apparatus Division

Manufacturing Engineers Since 1840

superintendent of the Bloomington and Normal Sanitary District, tells how the anti-sweat coating was applied. The materials were shellac and ground cork. The shellac was applied with a paint brush and the cork was placed by hand-patting it on the sticky shellac. After drying, the cork was covered with a coat of aluminum varnish. The only maintenance involved during the 22 years since the cork insulation was applied has been periodic cleanings with a vacuum cleaner and re-painting at two to three years intervals.

At times some sweating is experienced at the flanges, which have no insulation.

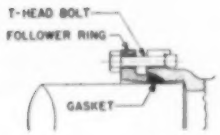
Sewage Plant Construction at Decreased Rate in 1952

The Nation's progress in reducing the pollution of its *water* resources through construction of municipal sewage treatment plants has been summarized in a report released by the Public Health Service, Department of Health, Education, and Welfare. The report indicated that in 1952, a total of 515 communities in the United States awarded contracts involving an expenditure of $137 million for this type of construction. Of these contracts, 314 were for new plants costing $78,419,556 and 201 were for additions, enlargements, or replacements of existing plants, costing $58,789,133.

The report compared the 1952 construction rate with the annual rate of from $450 million to $500 million estimated to be required over a 10-year period to bring the pollution caused by municipal wastes under reasonable control. The 1952 total of $137 million is less than that for any year since 1948, and also falls short of the long-term average of $141 million for the period 1915-1950.

MH

MECHANICAL JOINT FIRE HYDRANT



Made-up Mechanical Joint cut away to show its design.

Standard compression type fire hydrant made in full compliance with latest AWWA Specifications. Available in Standard model or Traffic model. Main valve opens against the pressure. Valve will remain closed in case hydrant is broken off in traffic accident. Features include low friction loss, high efficiency, revolving head, dry top, easy lubrication.

Hydrant shoe has two heavy lugs for use in strapping hydrant to pipe line. The end connection is Standardized Mechanical Joint in accordance with specifications of Cast Iron Pipe Research Association. A thick gasket is compressed by a bolted follower ring. Advantages include easy assembly, low joint cost; deflection, expansion and contraction without leakage. For complete information, write or wire M & H VALVE AND FITTINGS COMPANY, Anniston, Alabama.

M&H PRODUCTS FOR WATER WORKS • FILTER PLANTS INDUSTRY • SEWAGE DISPOSAL AND FIRE PROTECTION

NEW WATER & SEWAGE BOOKS

Manual on Industrial Water. Prepared by ASTM Committee D-19 on Industrial Water. Published by the Am. Soc. for Testing Materials, 1916 Race St., Philadelphia 3, Pa. ($4.25)

For executives, plant managers, designers, and technologists this book can serve as a guide to the nature of water planning required at supervisory and investment levels. Operating personnel, chemists and engineers can use the manual for specific technical information.

In its 344 pages, there are eight chapters on industrial water relating to uses, difficulties caused, composition, treatment, sampling and analysis; and on the sampling, identification, and analysis of water-formed deposits. Also included in the Manual are standardized definitions, sampling methods, and analytical methods resulting from the work of the society's Committee D-19. In one source, therefore, this book provides a critical discussion of important problems in, and a compilation of all ASTM standards for, industrial water.

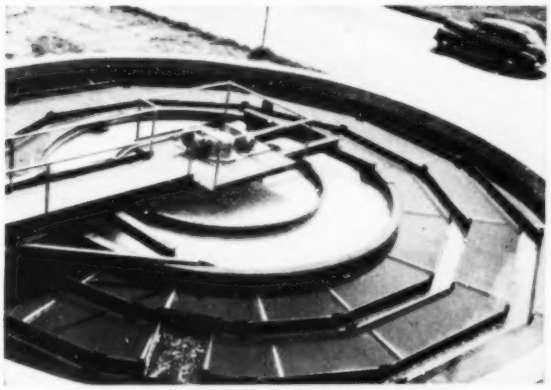
We are pleased to read, in the introduction that the Manual "should not be expected to replace competent and well-trained technologists. It will give general information to some and detailed information to others, but the design and efficient application of the treatments and techniques discussed require experience which no books can supply."

* * *

Simplified Drafting Practice, by W. L. Healy and A. H. Rau. (John

WALKER PROCESS means leadership

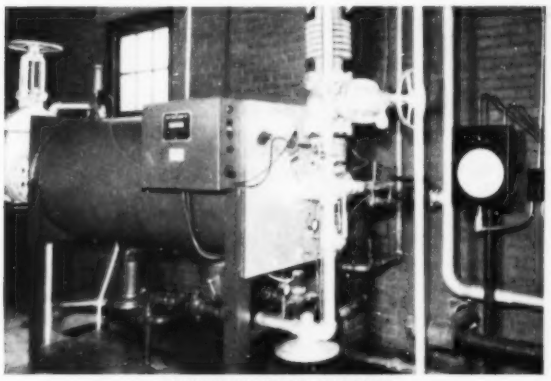
...in the treatment of WATER...SEWAGE...INDUSTRIAL WASTE



SALEM, VIRGINIA CIRCULAR CLARIFLOW

WALKER PROCESS iron filter

Iron, manganese and gas removed by back-washable, open contact filter. Less than 0.3 ppm of iron and manganese after one pass through contact media. Sectional back-wash eliminates media balling and wellsand build-ups . . . allows backwashing with raw water supply. No chemicals used. Low head loss. Write for Bulletin 1W51.



COLUMBUS, OHIO CARBALL

WALKER PROCESS carball

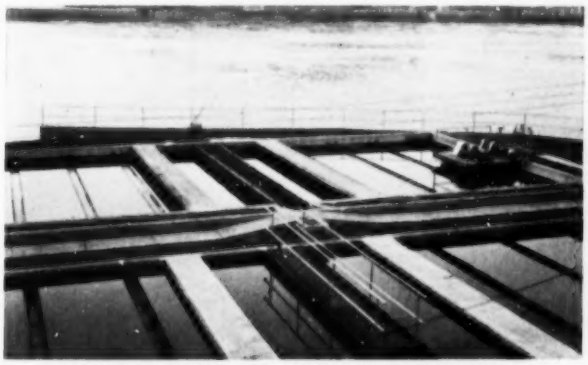
Efficient CO^2 Generator

Produces CO^2 gas at slightly more than 1/2 cent a pound! Gas is clean and tasteless because of high fuel-burning temperature. No need to compress CO^2, as it is under sufficient pressure from burning chamber for direct injection below absorbing liquid. Write for Bulletin 7W64.

WALKER PROCESS clariflow

for Water Softening and Turbidity Removal

A short period, truly vertical flow package reaction and clarification basin furnished with a positive collector mechanism and slurry return. Can be relied upon to produce more perfect results than the more clumsy older-type plain basins. The Energy Inlet through multiple balanced diffusion ports not only balances and homogenizes the inflow, but also gives beneficial slow flocculation just before flow enters the clarification (rise) area. Available in circular or rectangular units. Write for Bulletins 6W46.



NEW KENSINGTON, PA. RECTANGULAR CLARIFLOW

WALKER PROCESS collectors

for Sewage and Industrial Solids

Circular collectors in three types: tractor drive (tank periphery); suspended mechanism (on tank bridge); center drive (from center pier). Rectangular chain type collectors available for all sizes of rectangular tanks. Write for Bulletins 9W65 and 8W68. Collectors provided with either plow arms or multiple suction inlet arms.

FALL RIVER MASS. TRACTOR DRIVE

WALKER PROCESS EQUIPMENT INC. AURORA, ILL.

Wiley & Sons, Inc., New York, N.Y. $5.00)

The title of this book defines a practical approach and a major change in drafting procedures. The 135-page book advances the basic idea that drafting can be stripped of its frills while retaining clarity of presentation and accuracy of dimension. It proceeds to demonstrate how simplification of delineation, the elimination of non-essentials and extensive use of free-hand drawing can produce a recognizable time-saving of anywhere from 30 to 50%, leaving the way free for the more productive effort of creative thinking.

A generous quantity of "before and after" illustrations is accompanied by explanations of free hand drawing, the use of symbols, mechanical aids, and abbreviations. Arrowless dimensioning, legible lettering, tolerances, and reproduction processes are among the other simplified devices presented. The authors show how one idea alone —uniformity in the basic design of the drawing form—can prove more valuable to many firms than the modernization of their drafting practices.

Based on a comprehensive survey of General Electric's drafting practices, the new volume is designed for method and procedure men, office managers, and draftsmen in all phases of engineering.

Why we keep it DRY...

Dry chlorine is inert — you can ship it in ordinary steel cylinders and pipe it through iron pipe or even copper tubing. But add even the slightest trace of moisture to it and chlorine gas becomes highly corrosive.

That's why we designed BUILDERS Visible Flow CHLORINIZER to meter and control the flow of chlorine gas in its dry, non-corrosive state. Precision parts which assure the safe, dependable operation of these chlorine gas feeders stay "like new" even after years of service. Actual experience with hundreds and hundreds of installations throughout the country has proved the soundness of Chlorinizer's basic engineering . . . Yes, the right way to handle chlorine gas is the dry way.

For detailed information about Builders Chlorinizers, address Builders-Providence, Inc. (Division of B-I-F Industries), 350 Harris Avenue, Providence 1, Rhode Island.

BUILDERS-PROVIDENCE

BUILDERS

B-I-F INDUSTRIES

Harold Leeson Becomes Manager of Luippold Engineering Sales

Lida B. Luippold, widow of the late G. T. Luippold who succumbed to a heart attack on February 25th., announces that Luippold Engineering Sales Co. will be continued.

To succeed her late husband as head of the firm, Harold S. Leeson has accepted appointment as General Manager of the company. Robert Luippold, son of the late president will assist Mr. Leeson. Richard, another son will join the company after his service in the Navy.

Mr. Leeson leaves the Los Angeles engineering firm of Koebig and Koebig to assume management of the Luippold Co. Previous to that he was in the employ of Builders Providence Inc. for 25 years and for 5 years manager of their Los Angeles office. Therefore, Mr. Leeson assumes his new position thoroughly qualified to give top-flight service in the water and sewage works field.

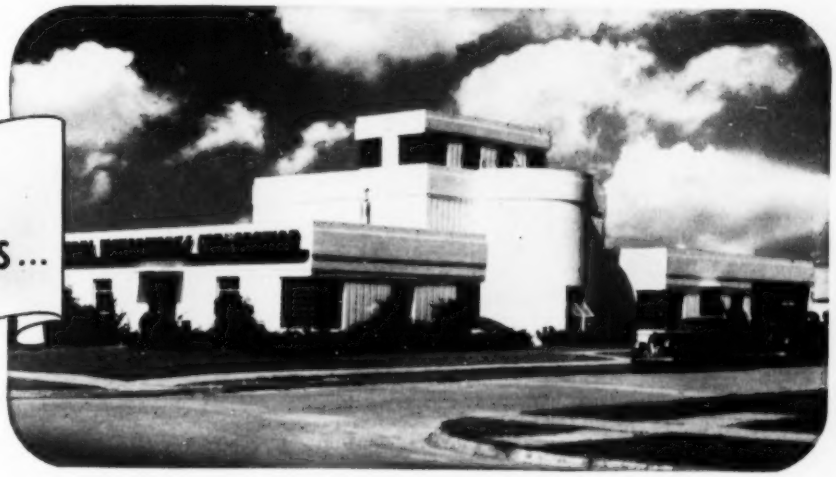
Cathodic Protection For Rust by Brush Application

701

Constad Laboratories, New York, N.Y., has developed "Formula #50," a new method of surface protection of iron and steel. The recently developed product is described as offering the advantages of "HOT DIP" galvanizing without the costly, time consuming need for dismantling and with an important savings of transportation costs to and from the "HOT DIP" Plart.

Applied easily with a brush or spray-gun (60-90 lbs. p.s.i. with a number 4 nozzle) formula #50 takes only one hour to dry. At brushing consistency it leaves a deposit of .25 ounces per square foot; of a thickness of only .005 to .007 inches. One gallon will cover 500 square feet.

The product differs basically from other types of metallic paints in that it can be used over rusted surfaces



For Economy in Both Choose Concrete

Using concrete in both water lines and waterworks buildings helps a community get good service and low rates for domestic and industrial users.

Concrete pipe has the durability that enables it to render long service in water lines. It has the strength to resist severe impact and carry heavy overburdens. It is not subject to internal corrosion resulting from tuberculation or electrolytic attack. This insures constant hydraulic efficiency. Concrete pipe stays clean, too, thus minimizing taste and odor problems and the unsightly staining of enamel plumbing fixtures. And the tight joints plus the uniformly dense structure of concrete pipe assure satisfactory watertightness.

Architectural concrete is ideal for waterworks structures. As in the Pine Bluff, Ark. General Waterworks plant shown above it can be used to create buildings that are both functional and distinctive. Such buildings stand out as symbols of sanitation and good management and are a source of community pride. Architectural concrete meets all structural requirements for durability, fire-safety and strength and can be molded economically into ornamentation of any style or period.

Concrete is economical construction both in water lines and waterworks buildings. It is moderate in first cost, costs less to maintain and lasts longer. The result is ***low-annual-cost*** service.

PORTLAND CEMENT ASSOCIATION

33 WEST GRAND AVENUE, CHICAGO 10, ILLINOIS

A national organization to improve and extend the uses of portland cement and concrete through scientific research and engineering field work

(loose scale removed) and that a galvanic action takes place through the rust, which is probably reduced to metallic iron (magnetite). The "formula #50" produces electrical continuity between the steel and the coating, thus preventing "RUST CREEP."

Beckman Opens Plant in New Jersey

Beckman Instruments, Inc., South Pasadena, Calif., has announced the transfer of its New York offices to a new, 20,000 square-foot plant in Mountainside, N.J.

The air-conditioned brick structure, tripling the size of Beckman's current east coast operation, is located on U.S. Highway 22 to New York, just 12 minutes from Newark Airport.

Functioning as northeast sales and service headquarters for the company, this building also will provide a branch manufacturing facility for the Beckman Helipot division, maker of helical potentiometers.

According to William H. Steinkamp, V. P. and General Manager, the plant will maintain a staff of factory-trained specialists and full stock of instrument replacement parts for eastern users of Beckman pH meters, spectrophotometers and other precision electronic units.

NEW...DIFFERENT...

PLASTIC BASE JC-60
CUTS SEWER SYSTEM COSTS

THESE ARE THE FACTS: JC-60® cuts sewer line *maintenance* costs. Joints poured with ATLAS JC-60 resist the common causes of sewer joint failure — root penetration, climate extremes, normal settling, loss of adhesion and chemical attack.

Operating costs go down. By reducing infiltration of soil water, JC-60 sewer joints reduce pumping costs and equipment capacity required at the disposal plant.

Installation costs go down. JC-60, with minimum shrinkage, high fluidity and resistance to overheating deterioration speeds the entire jointing procedure and minimizes material waste.

Years of ATLAS research created this remarkable new jointing compound. Based on a synthetic plastic, JC-60 is designed specifically to provide those characteristics proved most desirable in actual use.

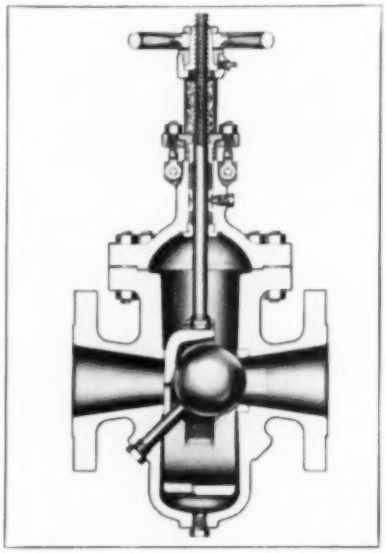
COMPLETE FACTS are in Bulletin M20-3 and other technical literature. *Write for your copies.*

OTHER ATLAS JOINTING MATERIALS *include* **GK®** *and* **SLIPJOINT GK®** *for sewer pipe:* **MINERALEAD®** *and* **HYDRORINGS®** *for cast iron water pipe.*

ATLAS JOINTING COMPOUNDS
. . . a permanent bond

ATLAS MINERAL PRODUCTS COMPANY MERTZTOWN PENNSYLVANIA

Engineering Representatives Throughout the United States



New Venturi Ball Valves

702

Crane Co., Chicago, Illinois, has announced a new line of valves, operating on a unique principle. The disc in these Crane-Paul valves, instead of being of conventional shape, is a ball. This ball is not attached directly to the stem, but rides in a cage which is attached to the stem by a tee-head slotted construction.

In operation, the ball is moved to and from the center of flow and rolls into and out of the body seat. The ball disc is mechanically locked in the closed position by a wedging member on the cage. In moving to the fully open position, the ball rolls out of the seat and up, until it is lined up vertically with the stem and is carried out of the path of flow.

The design provides unusually accurate flow control with a minimum of wire-drawing; straight-through flow with much lower pressure drop than that through a globe valve; absolutely tight shut-off; very easy operation; and complete freedom from vibration or chattering, regardless of position of the ball disc.

The new valves are available in venturi patterns, with flanged ends, in cast carbon steel and Crane 18-8 Mo alloy steel, and in a wide range of sizes beginning at 1-inch. Cast steel valves are available in 150, 300, and 600-pound classes, and alloy valves in 150 and 300-pound classes.

One fourth of the world's population still knows nothing about the use of soap.

Major Hagar Goes Into Business for Himself

Major C. Hagar, former Superintendent of Water for Lawrence, Kan., and more recently City Manager of Sterling, Kan., has gone into business for himself. At the A.W.W.A. Convention he was on hand meeting his many friends and passing out his new business cards on the face of which appears the above pen and ink drawing of "Helpful Hagar" as a peddler of fire hydrants and a variety of Water and Sewage Works equipment and materials.

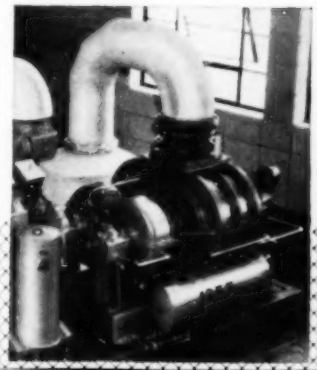
In other words Major (that's his name, not a title) Hagar has established himself as a manufacturer's agent with office in Sterling, Kan. His calling card lists on the back the following companies which he now represents—

A. Y. McDonald Mfg. Co. (Brass Goods and Copper Service Pipe)
A. P. Smith Mfg. Co. (Hydrants, Valves, Repair Sleeves, etc.)
Builders Iron Foundry (Rate Controllers, Chemical Feeders, Flow Meters, Chlorinators, etc.)
Yardley Plastics Co. (Service Pipe and Fittings)
Proportioneers Inc. (Chemical Solution Feeders)
A. J. Griner Co. (Lab. Equipment and Chemicals)
Trojan Mfg. Co. (Pipe Pushers and Pullers)
Palmer Filter Equip. Co. (Surface Filter Wash and Anthrafilt)
Keasby & Mattison Co. (Asbestos Cement Pipe)

Major has served as chairman of the Kansas Section of the A.W.W.A. and as member of the A.W.W.A. Board of Directors. His many friends are wishing him great success.

Tailored to the needs of any capacity plant by

BLOWER *Specialists*



ROTARY

CENTRIFUGAL

One important reason for the wide popularity of Roots-Connersville Blowers for sewage treatment work is their versatility. For instance:

TYPES . . . either Rotary Positive or Centrifugal—the only blowers that give you this *dual choice.*

CAPACITIES . . . from 10 cfm to 100,000 cfm or higher.

DRIVES . . . electric motor in any desired arrangement; gas engine, burning gas, sewage gas or gasoline.

Thus, your selection of blowers is practically unlimited when you consult the R-C specialists. Whether for industrial waste, or for a village or a metropolitan community, you can standardize on R-C equipment. If growth necessitates larger capacity, even after many years, you can add more R-C Blowers as needed, with the same assurance of continued satisfaction and reliability.

Almost a century of experience in building air- and gas-handling equipment, exclusively, is at your call on your blower applications.

ROOTS-CONNERSVILLE

Exclusive Specialists in Handling Gas and Air

ROOTS-CONNERSVILLE BLOWER

A DIVISION OF DRESSER INDUSTRIES, INC.
753 Mount Ave. • Connersville, Indiana

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

Silicone and Plastic Emulsion Waterproof Coating

703

Dasco Chemical Co., Baltimore, Md., has developed a new and different, clear, transparent silicone-base water-proofing material. The new product, Dascone, contains no solvents, chlorinated rubber phosphates nor butyl menthacralate.

Since it is solvent-free, Dascone absolutely eliminates the usual high flash point which has, in the past, created a fire hazard to men smoking during the application period.

According to the manufacturer, tests prove that it is the greatest development in the waterproofing field for above grade masonry walls in a quarter century. For example, it may be applied while walls are damp . . . and it doesn't leave them with a gloss or sheen appearance of any kind. Up to now, such a covering has always contained solvents, which prevent its use on any wall that is not completely dry.

Wilson of Worthington Retires

Worthington Corporation, Harrison, N.J. has announced that William O. Wilson, Commercial Vice President, has retired after 53 years service with Worthington and its predecessor companies.

Mr. Wilson has, since 1944, been responsible for general supervision and direction of all of the Corporation's commercial activities in the Chicago, St. Louis, Kansas City, and St. Paul District Office Territories.

He began his 53 years service with the Corporation in 1898 when he joined the Jeanesville Iron Works Company as a machinist. Mr. Wilson subsequently became an erecting engineer and a salesman. In 1919 he was appointed District Manager at Pittsburgh and in 1928 he was transferred to Chicago as District Manager.

Pekrul Gates get around . . .

To the four corners of the earth PEKRUL GATES are performing efficiently and dependably. PEKRUL Water Control Equipment is designed and developed to meet the most rigid requirements anywhere in the world.

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Flood Control	Sewage Disposal	Rearing Ponds
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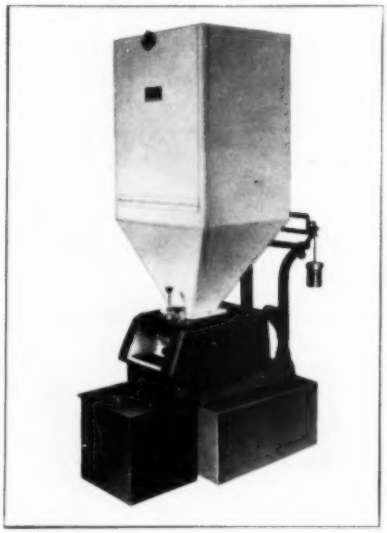
Dams	Fish Hatcheries	

Write for Catalog 49

PEKRUL GATE DIVISION

MORSE BROS. MACHINERY DENVER, COLORADO



New Compact Fluoridizer

704

Omega Machine Company, Providence, R. I., has developed an extremely accurate flouridizer of compact design, offering water plant operators a wide range feeder at a cost well within the means of small plant budgets. The new Model 50 Volumetric Fluoridizer is sturdily constructed with a streamline Meehanite housing. Its large hopper can easily hold a full 100 pound bag of fluoride compound so that partially emptied containers need not be left about the plant. Handling of chemical is reduced to a minimum as the bag is lifted only approximately two feet to the loading door. Filling operation is dustless.

A uniform rate of feed is maintained by a 40 Watt synchronous motor driving the slow moving feed disc. Changes in feed rates are obtained by a micrometer gate adjustment knob, assuring exact duplication of previously obtained feeds. An ac-

curacy of 3 per cent by weight over a 20 to 1 range is obtained by a large feeding orifice and gate adjustment calibrated to one-one thousandths of an inch.

The newly improved Omega flat disc feeding mechanism features a controlled angle of repose of the fluoride which assures uniform, volumetric feeding regardless of changing flow characteristics of the chemical. The feeding orifice is not easily clogged or changed in capacity by accretion.

A small lamp illuminates both feeding compartment and adjustable scale while feeder is operating, allowing full view of feeding through a transparent door.

Platform scales can be furnished with the feeder to check the actual weight-loss of the chemical being fed and to eliminate the necessity of catching samples. Eductors, dissolving chambers and mixers are also available with the Fluoridizer as needed.

The Model 50 can be easily arranged to feed automatically in proportion to flow through a measuring device such as a Venturi Tube or orifice plate with a Builders Chronoflow Transmitter. Contact type meters such as the Builders Propeloflo with an electric contactor built in the meter head can also be used.

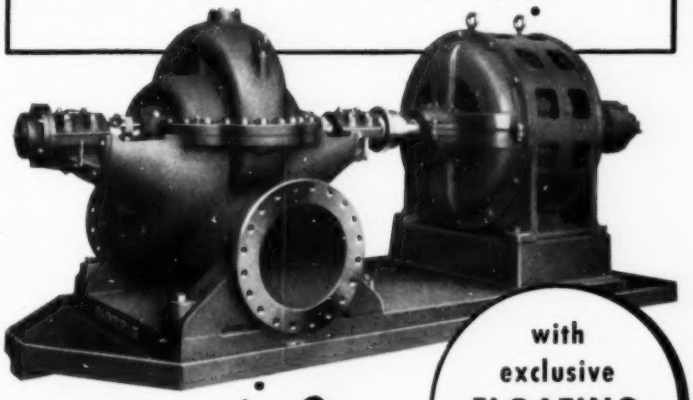
H. D. S. Chafee New Advertising Manager of Builders & Omega

Builders Iron Foundry, Providence, R.I., has announced that Mr. H. D. S. Chafee has been appointed Advertising Manager of Builders-Providence and Omega Machine Company.

Prior to joining B-I-F Industries he worked as a machinist apprentice at Brown & Sharpe Manufacturing Co. in Providence. He has been with Builders Iron Foundry since 1946 and has served as Manager of the Pittsburgh, Pa.; Seattle, Wash.; and New England sales offices.

Dexter Chafee is a graduate of Hope Street High School, Phillips Andover Academy and Brown Uni-

Minimum Leakage provides Maximum Efficiency



with exclusive FLOATING SEALING RINGS

Morris

Horizontally-Split Double-Suction

WATER PUMP

In a centrifugal pump the running joint between the impeller and the pump casing is a highly critical point. Since it operates under suction vacuum on one side and discharge pressure on the other, excessive leakage will adversely affect efficiency.

Morris' exclusive *Floating Sealing Rings* reduce this hazard. As the pump comes up to speed, the Floating Sealing Rings adjust themselves to a concentric close-running clearance around the impeller. When full speed is reached, internal hydraulic pressure forces the rings tightly against the precision-machined faces of the casing rings where they are held firmly in place. Leakage is kept at a minimum—initial efficiency is maintained for extremely long periods of service.

Built to Last Longer

There's no scrimping of materials in the construction of this pump. All parts are extra-heavy—intentionally—to withstand many more years of severe operating conditions.

Morris Horizontally-Split Double-Suction Pumps are built in sizes ranging from 2" to 20", and may be connected in series on a single bedplate for heads exceeding those which can be developed by a single pump. For further information, contact the Morris office nearest you or write for free Bulletin 179.

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Baldwinsville, N. Y.

Sales Offices in Principal Cities

MORRIS Centrifugal Pumps

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versity and is a member of the Providence Engineering Society, the Appalachian Mountain Club and the University Club of Providence. He is also a member of the Board of Directors of Builders Iron Foundry.

New Test for Solids in Boiler Water

705

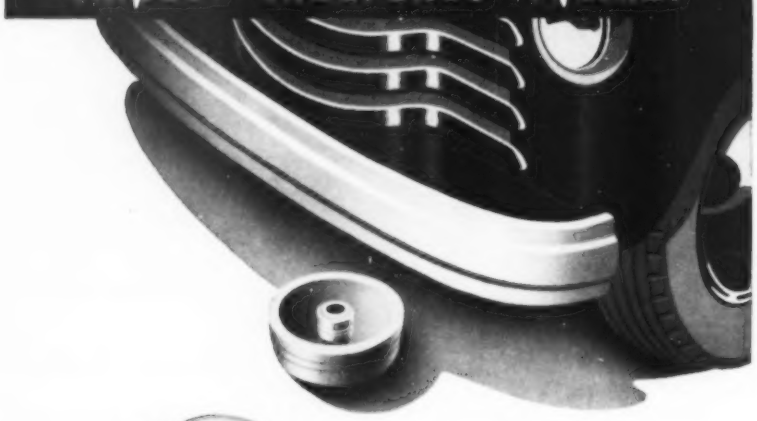
Hall Laboratories, Inc., Pittsburgh, Pa., has developed a new test for solids in boiler water, said to be comparable in accuracy and simplicity to the conductometric method.

Essentially the test involves mixing the boiler water sample with a strongly alkaline anion exchange resin, and titrating a portion of the resulting solution with acid to the proper endpoint.

A milliequivalent of hydroxide is formed for every milliequivalent of salt in the sample. The volume of standard acid required for the titration, multiplied by a suitable factor, gives an accurate measure of the dissolved solids in the sample.

Two procedures may be used, according to Hall engineers, depending on the degree of accuracy desired. With the "dropper test," which can be made in two minutes, results are reproducible to 200 ppm. dissolved solids. The more precise "burette test" requires about three minutes and gives results reproducible to within 25 to 50 ppm.

Impact Insurance Against



1—LOSS OF FIRE PROTECTION.

2—EXCAVATION AND PAVEMENT REPLACEMENT.

3—COSTLY REPAIRS INVOLVING MAJOR HYDRANT COMPONENTS.

4—FLOODING.

The Smith Protectop Hydrant is designed to permit rapid return to service at minimum cost when a Hydrant is damaged as a result of a traffic accident.

The Protectop Hydrant Standpipe and Valve Stem are equipped with Special Couplings located just above the ground. The Couplings withstand operating pressures and ordinary impact with an ample factor of safety. Under excessive impact occasioned by traffic accidents the Couplings fracture at the design points thus minimizing the damage and permitting speedy return to service at low cost.

All Smith Hydrants are equipped with Compression Type Valves which definitely eliminate flooding since the line pressure holds the Valve against its seat in the closed position.

Write for details.

38

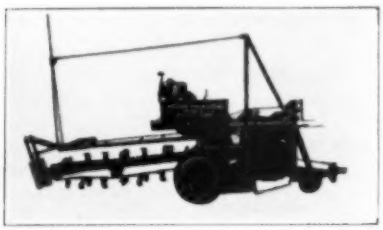
THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

Osborne Elected V. P. of U. S. Pipe

United States Pipe & Foundry Co., Burlington, N.J., has announced the election of Fred Osborne as a vice-president.

Mr. Osborne is a graduate of Clemson College and started with Sloss-Sheffield Steel and Iron Company, Birmingham, Ala. in 1926. Except for the period 1937-45, he was connected with the manufacturing end of the business in various capacities until his election as president and director of Sloss-Sheffield in April 1952. Last October when Sloss-Sheffield merged with U. S. Pipe he became president of the Sloss-Sheffield Division.



Low Cost, Self-Powered Ditcher

706

Vermeer Manufacturing Company, Pella, Iowa, has developed a low cost self-powered ditching machine.

The Model 6 Vermeer POW-R-DITCHER will dig up to 18 inches wide at a regulated speed of 1′, 2′ or 3′ per minute. Maximum digging depth is 6 feet.

The ditcher is ideal for tiling, laying gas, water and sewage lines and for digging foundation trenches.

Perfect balance affords simple hookup and easy trailing from car, truck or jeep. "Level-Matic" wheels allow straight up-and-down digging on slopes. The ditcher is self propelled by Wisconsin Air-Cooled Engines.

The POW-R-DITCHER is available also in two additional models: Model 24, which has a 24 inch digging width; and Model 6-V, with an adjustable V-blade for digging drainage ditches.

New Appointments at Homelite

Homelite Corporation, Port Chester, New York, has announced the appointment of E. W. McClellan as Midwest Regional Manager. Mr. McClellan, former manager of Homelite's Buffalo District Office, will open a new Midwest Regional Office at 120½ South Grove Avenue, Elgin, Illinois, on May 1st. He will be in charge of the Sales and Service activities of Homelite's District Offices in Detroit, Cleveland, Cincinnati, Indianapolis, Melrose Park, Kansas City and St. Paul; as well as Homelite branch offices in Toledo, Grand Rapids, Milwaukee, St. Louis and Omaha.

Also announced were the following changes in Branch and District Managers. Francis "Bud" Darrow, former assistant to Mr. McClellan in Buffalo, is appointed manager of the Buffalo District Office. Ted Skroch, present manager of the Grand Rapids, Michigan Branch Office, will be manager of the Indianapolis District Office. Harold E. Wiersum will be manager of the Branch Office in Grand Rapids, Michigan. James W. Thompson, now manager of the Indianapolis District Office, will take over the Charlotte, North Carolina District Office.

If we had to walk for a while in the other fellow's shoes, perhaps we wouldn't be so won't to criticize his progress.

STEVENS

TYPE B-FT RECORDER PROVIDES PERMANENT DATA ON SEWAGE FLOW

At this modern sewage treatment plant in Dallas, Oregon, the STEVENS Type B-FT Recorder provides a permanent graphic record of flow in million gallons per day (range 0-6 MGD) and totalizes the volume in gallons. The STEVENS Recorder is mounted over a stilling well connected to a 9" throat width Parshall flume.

record flow accurately . . . automatically

There is good reason why modern municipal sewage and industrial waste measuring installations use the STEVENS Type B Recorder. It may be wall, pedestal or panel mounted, is easily operated and will give a lifetime of accurate, trouble-free service. This Recorder uses a circular chart which makes one revolution per day or per seven days, as specified, while the pen swings in an arc around an external center—the combined movements thereby producing a graph of the rate of flow (or head) against time. Volume is indicated on a counter-type totalizer. Accuracy of the registration is limited only by the accuracy of the rating to which the totalizer is set. Flow or head (or both) may be indicated on a scale clearly visible through a large glass port.

RECORDS FLOW
RECORDS HEAD
TOTALIZES FLOW
Direct Float Operated or Remotely Controlled

To find out more about the STEVENS Type B Recorder, and how it can simplify the task of compiling accurate flow records, write for FREE Bulletin 25.

SEND FOR NEW STEVENS DATA BOOK

Puts interpretive data at your finger tips. 144 pages of technical data . . . information on float wells and recorder installations . . . a wealth of hydraulic tables and conversion tables.

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Submersible Sump Pump

707

Kenco, Inc., Lorain, Ohio, announces the development of a new submersible sump pump to take the place of an older model in their line. The New 109 is ideal for use in sumps, underground vaults, in transferring liquids, as contractor's portable pump and for general utility use. The entire outfit . . . motor, pump and switch are absolutely watertight, and are designed for operation completely emersed in liquid. It will fit into a 12" cube. Maximum capacity is 3300 gallons per hour at 10' head.

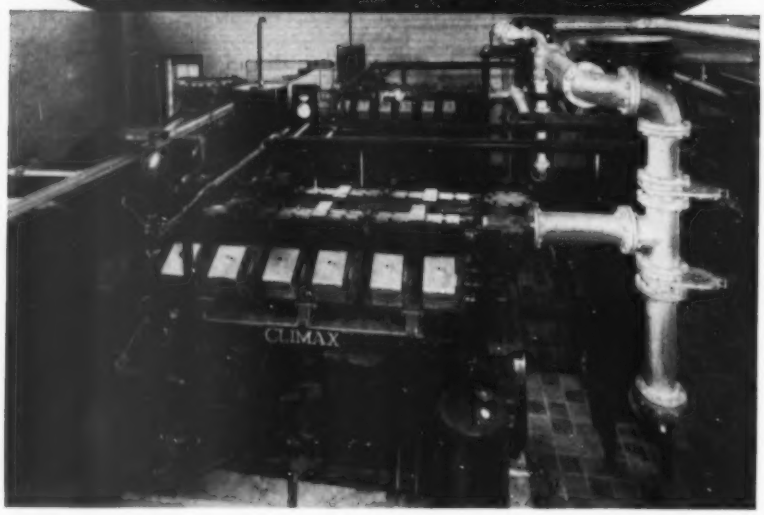
Major improvement in the new 109 is in the redesigned liquid level control switch. Perfect sealing watertight electrical connections positively seal out the water.

Hungerford & Terry Open Pittsburgh Office

Hungerford & Terry, Inc., Clayton, N. J., has announced the opening of a new office in Pittsburgh, Pa. It will handle the firm's business in the western part of Pennsylvania, southeastern Ohio, and northern West Virginia, and will be managed by Mr. Walter G. Guldbrandsen.

Mr. Guldbrandsen, a graduate engineer from Pratt Institute in Brooklyn, N. Y., has been connected with the Engineering Department at the main plant of the company for a great many years and is thoroughly familiar with water conditioning and the company's various products.

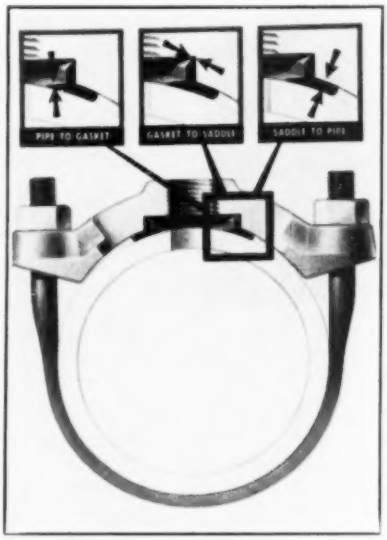
climax BLUE STREAK ENGINES
provide power in the new CANTON, OHIO
SEWAGE TREATMENT PLANT



The City of Canton, Ohio recently placed in operation its new activated sewage treatment plant designed by and built under the supervision of Alvord, Burdick & Howson, Engineers. This new plant has a design capacity of 20 MGD or a maximum of 30 MGD.

In addition to handling the sewage, the City's garbage is ground at the plant and is digested with the sewage which materially increases gas production. Each of the three 18 MGD Worthington sewage pumps is powered by a Climax Blue Streak 200 H.P., 700 RPM sewage gas engine. By means of automatic float controls engine speeds are varied to provide each pump with a discharge capacity of from 9 to 25 MGD against a head of 35 ft. Heat of the jacket water and exhaust gases is recovered and utilized for the digesters and buildings.

climax
ENGINE AND PUMP MFG. CO.
Factory and General Office: Clinton, Iowa
Regional Offices: Chicago, Ill., Dallas, Texas



Service Saddle

708

R. H. Baker and Company, Inc., Huntington Park, Calif., has developed the ShurSeal Saddle, a newly designed service saddle for water and gas use. Three sealing elements in the saddle's rubber gasket combine to effect a seal between the saddle and the pipe with only moderate tightening on the U-bolt. Straps which are under less tension resist corrosive attack more than conventional pipe saddles.

As the hydraulic pressure increases within the saddle, two unique wedge tips on the gasket are pressed harder against their sealing surfaces, and complete the seal started by the third seal—between the saddle and the pipe.

This "velvet glove" for the pipeline is furnished with single or double straps, either as a ShurSeal Cast Iron Saddle or a ShurSeal Bronze Saddle. Straps are formed accurately to fit the pipe, so as to distribute evenly the U-bolt pressure.

Made for pipe sizes from 1" to 24", and taps from ½" to 4". The ShurSeal Saddle eliminates "blow-out" at

the gasket, and treats the main to a gentle and evenly-distributed minimum squeeze.

William H. Waggoner Joins Neptune

The Neptune Meter Company, New York, N.Y., has announced that William Harold Waggoner of Britt, Iowa, has joined its sales force. He will represent the company in the sale of water meters in the state of Iowa, making his headquarters at the company's North Kansas City office.

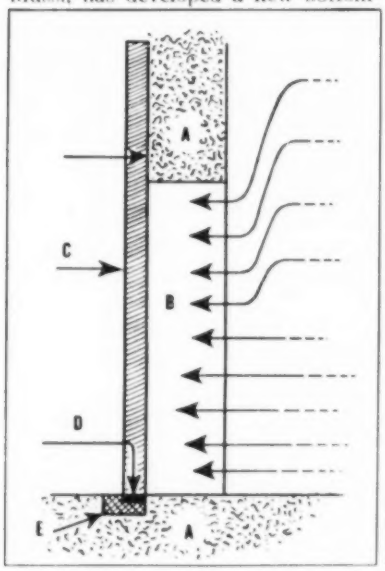
Mr. Waggoner served in the U. S. Army Signal Corps from 1942 to 1946. After his discharge from the Army, he attended the Iowa State Teachers College and graduated with B.A. degree.

Prior to coming with Neptune, he was a teacher in Britt, Iowa.

Bottom-Seating Sluice Gate

709

Rodney Hunt Machine Co., Orange, Mass., has developed a new bottom-



If your process requires the valving of "hard-to-handle" fluids . . .

HILLS-McCANNA

Saunders Patent

diaphragm valves provide the answer

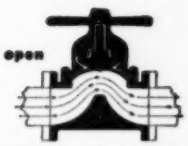
Leakproof valving of air . . . corrosive materials . . . slurries . . . solids . . . volatile and viscous substances

Hills-McCanna Diaphragm Valves can eliminate the problems involved in valving many of the so-called "hard-to-handle" fluids. By employing a simple pinch clamp principle, Hills-McCanna valves put an end to leakage, repacking and contamination.

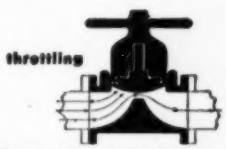
Hills-McCanna Valves are available handwheel or lever operated or for operation by pneumatic or hydraulic cylinders, diaphragm motors, electric motors, etc. Choice of 14 diaphragm materials, 49 body materials. Sizes from ⅜" to 14". Suitable for pressures to 150 psi., temperatures to 180° F. (higher with special materials). Screwed or flanged connections.

Write for Catalog V-52, HILLS-McCANNA CO., 2357 W. Nelson St., Chicago 18, Ill.

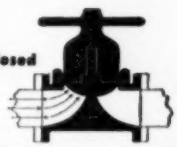
THIS SIMPLE PRINCIPLE ASSURES POSITIVE LEAK TIGHT VALVING



Compressor is raised, lifting diaphragm by means of a stud molded into the material.



Compressor and diaphragm partially lowered. Compressor design guides and supports diaphragm.



Compressor presses diaphragm tightly against weir, pinching off flow and making a tight seal.

HILLS-McCANNA

saunders patent diaphragm valves

Also Manufacturers of Proportioning Pumps Force Feed Lubricators • Magnesium Alloy Castings

seating sluice gate that improves flow characteristics.

As shown in the above drawing, AA are the concrete walls and sill, B is the opening, and C is the sluice gate. The new addition is D, which is a firm but resilient neoprene cushion attached to the bottom of the gate slide; and E, a machined cast iron seat against which the neoprene cushion seats tightly. The drawing also shows that the frame has been lowered so that the opening is flush with adjacent chamber floors, or with natural bottom flow-line. Bottom seating of the gate assures tight closure against flow in either direction.

According to the company, this new design provides more head and faster flow. The flushing action is superior so that silt is more effectively swept out, also there is no wall for silt and trash to build up against. There is less bottom turbulence, and drainage of the outflowing chamber is complete and dry.

Niagara Alkali Makes Two New Appointments

Niagara Alkali Company, New York, N.Y., has announced the appointment of James E. Ferris as director of sales and M. F. McCombs as manager, Chlor-Alkali sales. Both positions are newly created.

Mr. Ferris, who is past president of the Salesmen's Association of the American Chemical Industry, joined the company in 1926, and has been in sales since 1931. He is on the board of directors of the Compressed Gas Association and the board of governors of the Chemical Specialties Manufacturer's Association.

Mr. McCombs came to the company in 1921, and has been in sales since 1923.

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EFFICIENT REGULATION OF DISTRIBUTION PRESSURES IS A PROVEN METHOD OF CONSERVATION IN THE FIGHT AGAINST
DIMINISHING WATER SUPPLIES

PRESSURE REDUCING VALVES

Maintains constant discharge pressure for all changes in rates of flow down stream.

ROSS
1879

BACK-PRESSURE VALVE

Maintains constant upstream pressure regardless of draft down stream.

COMBINATION
PRESSURE REDUCING AND BACK-PRESSURE VALVE

OTHER ROSS PRODUCTS
ALTITUDE VALVES • FLOAT VALVES • RELIEF VALVES
HYDRAULIC BOOSTER PUMPS
STRAINERS AND SPECIALTIES

Write for Catalog #50

ROSS VALVE MANUFACTURING CO., INC.
4 OAKWOOD AVENUE——TROY, NEW YORK

75 H.P. Totally-Enclosed Turbine Pump Motors

710

U. S. Electrical Motors, Inc., Los Angeles, Calif., has increased to 75 the horsepower ratings of totally-enclosed and explosion-proof vertical pump motors. Available with either hollow shaft or solid shaft construction, these motors are designed for powering turbine pumps in refineries, sewage disposal plants, dangerous, dusty or dirty locations.

U. S. explosion-proof vertical motors are designed to comply with Underwriters' specifications for Class I—Group D, highly inflammable gases and volatile liquids and Class II—Groups F and G, for combustible dusts. The totally-enclosed vertical motors are ideally suited for service in plants or locations where non-explosive conditions prevail, for protection against non-combustible dust, dirt, moisture, abrasives and corrosive-forming drippings. Both type

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WATER & SEWAGE WORKS READER SERVICE

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NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

motors are double-enclosed for fullest protection with generous size built-in fan for rapid heat dissipation.

J. Allan Greenland

Donald T. Bixby

New Sales Managers for De Laval

De Laval Steam Turbine Co., Trenton, N.J., has announced that J. Allan Greenland has been named sales manager of the San Francisco District office of the De Laval Turbine Pacific Co. and Donald T. Bixby as sales manager of the Seattle District office.

Mr. Greenland joined De Laval in 1938 as a test engineer at the Trenton plant and served in various engineering and sales capacities until transferred to the Seattle office as sales engineer. He was appointed sales manager of the Seattle District office in 1948. Mr. Greenland was graduated from Rose Polytechnic Institute in 1938.

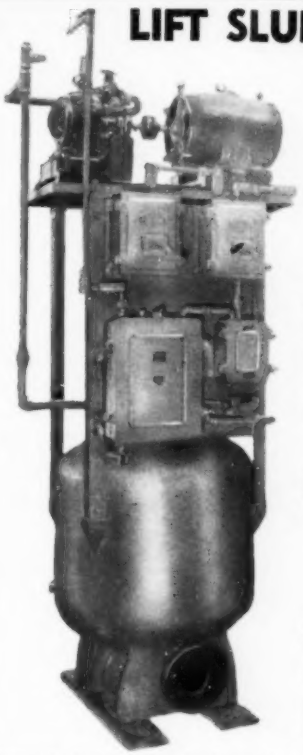
Mr. Bixby came to De Laval in 1945 as a sales trainee and served in a sales engineering capacity in the Standard Products Division until transferred to San Francisco in 1951. Mr. Bixby studied engineering at Rutgers University.

New Valve Has Resilient Seat

711

Keystone Tool Corporation, Houston, Texas, has developed a new, improved type of butterfly valve that will hold pressure or vacuum, and is able to shut off completely against suspended solids.

Key to the new valve's versatility is its resilient neoprene seat. The resilient sealing element effects a complete shut-off against pressure or vacuum, especially where sand or other solids are present in the stream. A resilient seal ring exerts positive pressure against the butterfly disk when the valve is closed. It is not subject to scoring by abrasive par-



Compact ejector system having motor compressor assembly and all controls in one "packaged" unit.

LIFT SLUDGE AND SEWAGE

. . Unfailingly . . With Rugged, Dependable

BLACKBURN-SMITH PNEUMATIC SEWAGE EJECTORS

Obviate complex piping for air and water. Eliminate clogging of screens, impellers, and shredders.

30 to 500 GPM in both single and twin units against high discharge heads.

Exclusive Modern Features

Over 50 years service has proved the worth of Blackburn-Smith Ejectors. Yet our today's product is full of exclusive modern features such as:

1. Float and electrical float switch controls.
2. Float and pneumatically controlled snap action valve.
3. Electrode controls.

Any one of the above, with or without Air Receivers. Get Catalog S.

REPRESENTATIVES WANTED. ADDRESS:

Blackburn-Smith Mfg. Co. Inc.

98 River St., Hoboken, N. J.

Phones: HOboken 3-4425
REctor 2-9360

DAM REPAIRED WITH "GUNITE"

The two photographs show the Bulls Bridge Dam of the Connecticut Light and Power Company, which is one of many dams we have repaired for this Company.

The upper view shows the work in progress, and gives some idea of the condition of this structure before repairs were made. The lower view is of the completed job.

After chipping out the loose and disintegrated concrete and sandblasting the entire area, heavy reinforcing mesh was placed over the surface of the old concrete and "GUNITE" applied two inches thick, plus the material required for filling deeply eroded portions.

Our 72-page bulletin C-2400 describes scores of similar "GUNITE" jobs.

Write today for bulletin C-2400

CEMENT GUN COMPANY

"GUNITE" CONTRACTORS

GENERAL OFFICES – ALLENTOWN, PA., U. S. A.

MANUFACTURERS OF THE "CEMENT GUN"

ticles. And, if a bit of solid is caught between the disk and the seat, the resilient seat will deform around it and still maintain a tight seal.

Neoprene is used for the seat because it's proved resistant to the greatest number of chemicals and oils that might flow through the line; it also exhibited high strength and abrasion resistance—important factors where contact with slurries is involved. In addition, it has low compression set, which assures good sealing over long periods of service.

The replaceable seat is firmly held inside a specially constructed ring that supports both ends of the stem. Corrosion and leaks are prevented by a bronze bushing and a gasket seal at the top of the stem where it projects through the ring casting. The disk can also be made of aluminum bronze or manganese bronze to resist corrosion.

The flanged end fittings are bolted together across the contained rubber seat and outer ring support. This permits easy removal of the valve for inspection or repair without breaking the line. The valve handle is spring-loaded and locks securely in the open and closed positions.

Each size valve has a full hole opening and is self-cleaning. The disk is designed so that, in the open position, there is full line flow with practically no resistance or turbulence. Construction is such that no grease is needed for ease of operation.

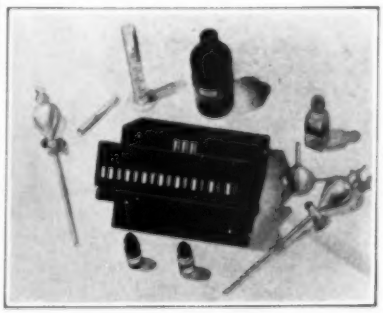
The valves were designed for operating pressures up to 150 psi, and are made in a complete range of sizes from 2 through 12 inches.

Wallace & Tiernan Ltd. Moves to New Canadian Plant

Wallace & Tiernan, Limited of Canada has moved to its new, modern head office and manufacturing plant outside of Toronto.

Located in Scarborough Township, eight miles from the heart of Toronto, the new expanded plant will enable Wallace & Tiernan to serve more efficiently their many customers and friends throughout Canada.

The new facilities will be the headquarters for all W&T Limited operations, including chlorine and chemical control equipment, precision instruments and flour treatment service.



Comparator Determines Synthetic Detergents in Sewage Wastes

712

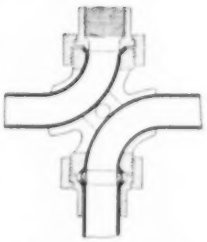
W. A. Taylor & Co., Baltimore, Md., have added a comparator called the Syndet Comparator for determin-

For an Ideal

BASEMENT SETTING

The Ford Copperhorn provides a permanent, solidly lined-up setting for basement meters installed on vertical pipe lines. Even when meters are changed, the piping remains connected.

The meter is set horizontally and at the most convenient height for easy reading. Smooth waterways—see diagram at right—cut pipe friction or pressure loss to less than half that through ordinary fittings. Economy and permanent, trouble-free service is assured.



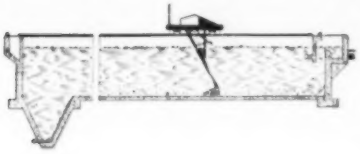
Note the smooth all-copper waterways that reduce friction to a minimum. Connections optional for either copper or iron pipe.

FREE Send for Catalog that shows the complete Ford line of economical meter setting products.

FOR BETTER WATER SERVICES

FORD

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

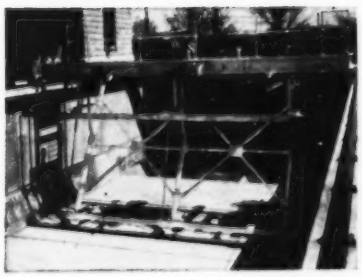


ing the synthetic detergent content of sewage wastes to their line of color comparators for pH, chlorine and phosphate determinations, as well as complete water analysis.

The Syndet Comparator operates on the same principle as all other Taylor Sets, that of colorimetric comparison.

The complete Taylor Syndet Comparator includes a sturdy plastic base and slide with guaranteed color standards, all reagents and accessories. The Syndet Comparator was added in response to many inquiries on the availability of such equipment by sewage plant operators.

RECTANGLAR CLARIFIERS FOR SEWAGE AND TRADE WASTES



Particularly suitable where space is limited or where sludge delivery is desired at one end of tank. Consists of a bridge crane spanning width of the tank supporting sludge scraper and skimmer, which moves automatically back and forth.

Many of these units are now operating in sewage plants throughout the country.

This unit has also proven highly successful as an oil-water separator in the treatment of oil refinery waste water. Bulletin 31-D-15.

HARDINGE
COMPANY, INCORPORATED
YORK, PENNSYLVANIA · 240 Arch St. · Main Office and Works
New York · Toronto · Chicago · Hibbing · Houston · Salt Lake City · San Francisco

Schwarz Promoted by De Laval

De Laval Steam Turbine Co., Trenton, N.J., has announced the promotion of S. Leonard Schwarz to superintendent of De Laval's North Plant.

Mr. Schwarz studied mechanical engineering in the evening at the Drexel Institute of Technology, while working as a tool maker's apprentice at the Frankford Arsenal in Philadelphia.

He joined De Laval as a project engineer in the methods department of the plant, after service in the U. S. Navy from 1942 to 1946.

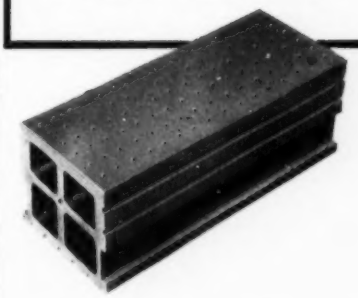
In October 1947 he was made general foreman of De Laval's North Plant small pump department, and became assistant superintendent of shop operations in 1951.

Cleveland Model 92 Trencher Now Equipped with 4-Speed Transmission

713

Cleveland Trencher Company, Cleveland, Ohio, has developed a new easy shifting 4-speed motor transmission for the Cleveland Model 92 Baby Digger. The new unit doubles the number of digging wheel and traction speeds previously available in the 92, providing for a more evenly gradu-

IT PAYS TO *Specify*
LEOPOLD
Glazed Tile
FILTER BOTTOMS



PERFORMANCE PROVED IN OVER 200 PLANTS WITH A DAILY CAPACITY OF MORE THAN 900 MILLION GALLONS!

With its many exclusive advantages, the Leopold Compound Duplex Filter Bottom provides the most practical and economical answer to your underdrain problems.

In this design, laterals and distributing blocks are combined in one permanent unit that insures uniform filtration over the entire filter bed and equal distribution of the wash water with minimum loss of head. The individual blocks—each about two square feet in area and weighing approximately 100 pounds—are made of highest quality de-aired fire clay, vitrified and salt glazed. They resist corrosion, are not subject to tuberculation, won't absorb any detrimental amount of water, and are impervious to acids and alkalis.

Adaptable to any rectangular filter unit, the efficient Leopold Filter Bottom needs only a shallow depth of small sized filter gravel to support the filtering medium. Further, the Leopold design does not require special supporting concrete members or the added concrete construction of a false bottom.

Complete Water Purification and Sewage Plant Equipment . . .

- **DRY CHEMICAL FEEDERS**
- **FILTER OPERATING TABLES**
- **MIXING EQUIPMENT**

Write today for details

F. B. Leopold Co., Inc.
2413 W. Carson Street
Pittsburgh 4, Pa.

ated progression of usable speed combinations.

The Cleveland 92 is a small, compact, tough trencher with exceptional maneuverability and mobility designed for use in crowded city and suburban areas.

For each of the new transmission's four wheel speeds (4 forward and 1 reverse) there are 12 crawler speeds. The 48 speed combinations thus developed provide 30 or more smoothly balanced, usable digging speed combinations ranging from .45 to 34.6 F.P.M. These combinations furnish the right speed for all types of trenching conditions.

The transmission is completely contained in a welded steel oil tight housing. The unit is equipped with anti-friction bearings. Its alloy steel gears are machine cut, case-hardened and heat treated.

Triangle Conduit Appoints Daly Sales Director

Triangle Conduit & Cable Co., Inc., New Brunswick, N.J., has announced the appointment of James D. Daly as Director of Sales of the Brass and Copper Tube Division.

Mr. Daly was formerly associated with the Graybar Electric Company. He had been with the company since 1934. Most recently he served them in the capacity of Eastern District Sales Manager.

SPRINGLOAD

A-C TENON TOOL

Machines Lathe-Smooth Tenons On-the-Job!

● ELIMINATES SHOP COSTS—HAULING COSTS—ADAPTERS

2 SIZES: 4" to 8"; 10" to 20" Handles *All* Pipe!

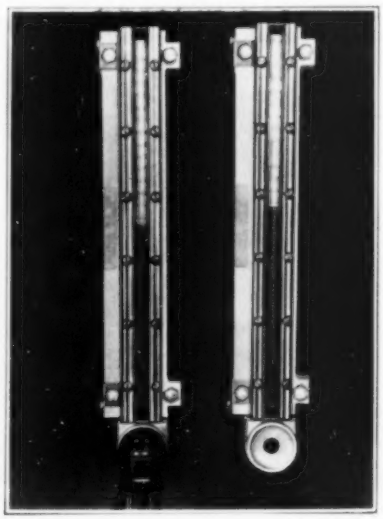
SPRINGLOAD A-C PIPE CUTTER

Cuts Pipe 3" to 24"

Fastest Cutter made for Century and Transite Pipe. True Cuts—No Hand Sawing

SALES REPRESENTATIVES:
Write for complete details of the Springload franchise in your territory.

H. D. FOWLER CO., Inc. P. O. BOX 3084 SEATTLE 14, WASH.



Liquid Level Gauge

714

Nathan Manufacturing Corp., New York, N.Y., are now offering Glo-Rod liquid level and tank filling gauges. These specially designed gauges are particularly useful for colorless liquids and daylight sight readings, giving instantaneous, accurate checks with no light loss through reflection.

Normal illumination is sufficient to transmit the light upward through the plastic rod causing the liquid to appear as dots below the surface of the liquid and as dashes above the liquid. The gauge can be, when applied in darkened areas, illuminated by a flashlight. A compact electric unit is furnished when permanent lighting is required.

In the longer models there are targets at both top and bottom for directing flashlight for easy reading from either end when artificial light is necessary. Where the gauge is needed for use in restricted space there are Glo-Rod gauges with the reading face offset 30° or 90°. The angular offset is available for either right or left hand application.

Fisher Scientific Appoints Mexican Representative

Fisher Scientific Co., Pittsburgh, Pa., has announced that Manual Nuno has been appointed the first technical representative of Fisher

Scientific in the Republic of Mexico. He will head the Company's Mexico City office to assist chemists, metallurgists and pathologists in the Republic's growing industrial, research, clinical and university laboratories.

Chemist Nuno received a B.S. degree from St. Benedict's College, and his M.S. in Organic Chemistry from Creighton University. He is also a graduate of Fisher Scientific's school of applied instrumentation in Pittsburgh.

Before joining Fisher's technical sales staff, Nuno was an instructor in Chemistry at Creighton University; then a member of Dow Chemical Company's aromatics division in Jersey City, N.J.

New Measure Marked Plastex Pipe

715

Plastex Pipe and Extrusion Co., Columbus, Ohio, has available a completely new, more convenient, positively identified flexible plastic pipe.

Trade name for the new pipe is PLASTEX Measure Marked Pipe, so-called because the PLASTEX name is permanently impressed into the pipe in a contrasting color at exact 10 foot intervals throughout the coil. With this new development, installations are speeded up because any measurement can be quickly and accurately calculated to a fraction of an inch with an ordinary pocket rule.

PLASTEX Measure Marked Pipe is made in one grade of 100% pure polyethelene and is guaranteed nontoxic, and is available in sizes of ½ to 6 inches with a complete range of fittings.

NO OTHER PIPE JOINT Can Equal BOND-O

- *In First Cost*
- *In Uniformity*
- *In Performance*

A careful survey of pipe joint costs will surprise you as to how much you can save with BOND-O. The low installation cost as well as a perfect performance record proves that nothing else equals BOND-O.

This self-caulking compound is accurately formulated and is used for jointing cast iron bell and spigot pipe.

Machine-b'ended by a unique process, BOND-O makes joints that are uniform and trouble-free. No BOND-O failure has ever been reported.

Write for literature today.

NORTHROP & COMPANY, INC.
SPRING VALLEY, N. Y.

W. S. ROCKWELL Butterfly Valves

Minimum Pressure Drop
•
Automatic or Manual Control
•
for Any Operating Condition to 300 p.s.i. and 2000° F.
•
of any metal or rubber-lined in sizes to 120"

ROCKWELL SINCE 1888 BUILT

W. S. ROCKWELL COMPANY

BUTTERFLY VALVES • SLIDE VALVES • AUTOMATIC VALVES

2763 ELIOT STREET • FAIRFIELD, CONN.

Sales Representatives in Principal Cities

Chicago Bridge Elects Sangdahl V. P.

Chicago Bridge & Iron Company, Chicago, Illinois has announced that Mr. George S. Sangdahl was elected a Vice President of the company on April 13, 1953. He has been associated with the Company since Jan. 15th, 1915.

Mr. Sangdahl was graduated with B. S. degree in Engineering from the University of Illinois in 1913. He started working in the Sales department of the Chicago Bridge & Iron Company doing design and estimating work, was Manager of the Montreal, Que., Sales office of the Company's Canadian affiliate, Horton Steel Works Limited, for five years, and has been Manager of the Company's Cleveland Sales office since 1925.

On May 4th Mr. Sangdahl became Manager of a new sales office which the Chicago Bridge and Iron Company opened in Pittsburgh, Pa. It is located in the Alcoa Building.

New Large-Area Metallic Electrodes Multiply Benefits From Redox Potentials

716

Beckman Instruments, Inc., South Pasadena, Calif., has developed a new series of large-area metallic electrodes pointing to greater benefits from the oxidation reduction potential control technique.

The electrodes offer broad surfaces of metal—platinum, gold, silver or nickel—mounted in three basic styles for all kinds of industrial and laboratory service. Their larger sensing area assures fast response, minimized polarization effects, easier cleaning and maximum thermal stability.

Of rugged construction, the electrodes will withstand temperatures to boiling or above. They can be used with any Beckman pH meter or automatic titrator.

Bristol Names Gewin St. Louis Manager

The Bristol Company, Waterbury, Conn., has announced the appointment of Sam E. Gewin as District Manager of the company's St. Louis office.

After graduating from the University of Alabama in 1934 with a degree in Chemistry, Metallurgy & Ceramics, he was associated with the U. S. Industrial Chemical Company for 3 years prior to joining the Bristol sales organization in 1937 as sales engineer. For the last five years he has been Resident Sales Engineer in the Buffalo area.

Mr. Gewin's new headquarters will be in the company's St. Louis office, located in the Cotton Belt Building.

Banish HORRID Summer SEWER SMELLS

with Fast Flexible BUCKET MACHINE CLEANING

9,000 POUND PULL
Lifts Any Bucket That Will Pass a 24" Manhole Cover.

Here is the fastest *plus* operating bucket machine on the market. It's proven, trouble-free, patented belt-drive is much superior to transmission-operated machines.

Only one lever to use (instead of three)--which protects operator, pipe and machine. Why put up with summer sewer smells when Flexible cleans thoroughly--so economically? Let us prove it with facts and figures

WRITE today

Flexible
SEWER-ROD EQUIPMENT CO.
9059 VENICE BOULEVARD, LOS ANGELES 34, CALIF.

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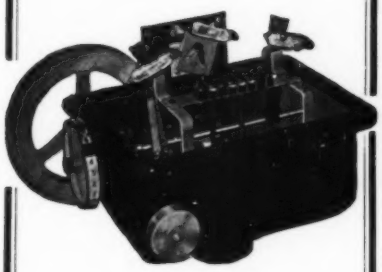
AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS AND EQUIPMENT

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles. The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

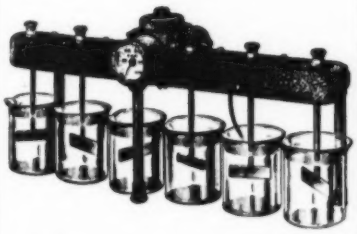
Write for full data

WATER LEVEL CONTROLS DIVISION

HEALY-RUFF COMPANY

783 HAMPDEN AVE., ST. PAUL 4, MINN.

P & B Multiple Stirrer



When several samples are mixed simultaneously under identical conditions the optimum concentration of flocculent may be quickly selected and translated to plant quantities . . . The mixes takes 1,000 ml. beakers. Speeds from 10 to 100 r.p.m. are standard.

Write: Cat. No. 77-700

Phipps & Bird, Inc.

P. O. Box 2V Richmond 5, Va.

Spring Gives Bench Vise Instant Adjustment with Non-Slip Grip

717

Springload Mfg. Corp., Seattle, Wash., has developed a new "Springload" bench vise, designed with a spring and ratchet arrangement that adjusts instantly to give a non-slip grip by hooking the chain around the pipe as usual, and depressing a handle to adjust tension. The sliding ratchet holds the handle down and tension on the chain until released.

The spring arrangement provides instant, non-slip adjustment, eliminating the slow tension screw adjustment method, and also eliminating the "knuckle-buster" bolts under the old style bench vise set up.

The vise is available in two sizes, one for ½" to 2" pipe; the other for ¼" to 4" pipe.

Kooperman, Inc. Appointed Insul-Mastic Licensee

The Insul-Mastic Corporation of America, Pittsburgh, Pa., has announced the appointment of S. W. Kooperman, Inc. of Philadelphia as a Licensee to handle the sale and application of Insul-Mastic protective coatings in that area.

S. W. Kooperman, Inc. are well known industrial painting contractors who are skilled in surface preparation. The company is prepared now to spray the heavy Insul-Mastic coatings on tanks, ducts, vessels, pipes and wherever corrosion may occur. They will also employ Insul-Mastic to vaporseal Thermal insulation and to waterproof buildings.

FOR SALE

Coloco Sludge Concentration Unit, slightly used, in excellent condition. Model EWO-D-102—Ideal for small sewage works. For complete details write: Box 1111.

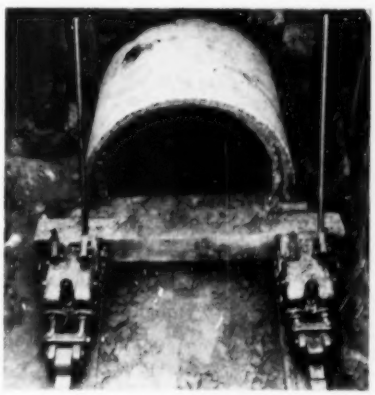
Water & Sewage Works

22 W. Maple St. Chicago 10, Illinois

FAST, EASY WAY TO INSTALL PIPE... AT LOWER COST

PUSH PIPE UNDERGROUND WITH A GREENLEE HYDRAULIC PUSHER

Here's the simple, cost-cutting way to install underground pipe. Speed your jobs with a GREENLEE Pusher. One-man-operated, portable, simple to operate. No tearing up of pavement . . . eliminates extensive ditching, tunneling, backfilling, tamping, repaving. Cuts job time to a fraction. GREENLEE Hydraulic Pipe Pusher often pays for itself on first job. Two sizes — model shown above for pushing 3/4" to 4" pipe. Larger unit, below, for pipe over 4", concrete sewer pipe and large drainage ducts. Power pump (as shown above) also available for extra ease and speed of operation.



TOOLS FOR CRAFTSMEN

GREENLEE

Write today for descriptive literature. Greenlee Tool Co., 2247 Columbia Avenue, Rockford, Illinois, U.S.A.

● If interested in equipment or literature mentioned below, mail a Reader Service Card with your name, address, and item key number.

Literature & Catalogs

Pipe Puller and Pusher

718

Trojan Manufacturing Co., Troy, Ohio, has released a 4-page folder on the **Trojan Pipe Puller & Pusher.**

According to the folder, the double action of the Trojans will more than cut in half the labor and job time required by an ordinary pusher. Model A and Model B are shown along with all necessary accessories. The back page is devoted to a partial list of water works departments using the Trojan pipe puller and pusher.

Questions and Answers on Kraloy Plastic Pipe

719

Kraloy Plastic Pipe Co., Inc., Los Angeles, Calif., has a 2-page bulletin on **Kraloy Pipe, and Usual Questions Asked.**

The bulletin presents factual information on the 14 most frequently asked questions about Kraloy pipe. Data presented covers: what the pipe is made of; is it toxic; sizes; advantages; cost comparison to steel pipe; life expectancy; maintenance costs; and limitations of the pipe.

Model 92 Baby Digger

720

The Cleveland Trencher Company, Cleveland, Ohio, recently issued an 8-page bulletin on the improved **Cleveland Model 92** which is now equipped with a 4-speed motor transmission. The new unit doubles the number of digging wheel and traction speeds previously available in the 92.

Center spread of the bulletin contains complete information on the design and construction of the 92. A table of digging wheel and traction speeds furnished by the new transmission is prominently displayed on page 4. Text accurately describes component parts and special Cleveland features.

The wide versatility of the Cleveland Model 92 is featured in the bulletin. Action photographs illustrate numerous job applications. Strong emphasis is placed on the safe, fast mobility of the Model 92 teamed with its partner the Model T-5 trailer.

Pipe Cutters

721

Ellis & Ford Mfg. Co., Ferndale, Michigan, has available a folder on the **Ellis Pipe Cutter.**

The folder describes the cutter as an all-purpose cutter, with interchangeable cutter wheels for all types of pipe—cast iron and steel, as well as vitreous clay pipe. Also discussed in the folder are parts lists, list of cutter wheels, pins and rollers. The back page contains information on Ellis pipe clamps and plugs.

Root Removal from Sewers

722

Hercules Chemical Company, New York, N.Y., has published a folder which covers briefly but effectively the facts about sewer line obstructions caused by tree and shrub roots, and suggests means of solving the root-removal problem permanently.

Hercules own root destroyer, R-D —which is finding wide application across the country—is fully dis-

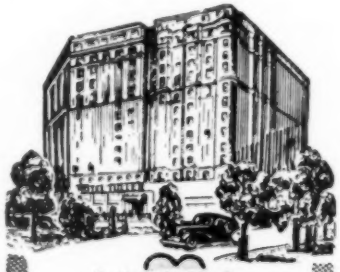
Cast iron pipe centrifugally cast and with mechanical joints is the most efficient and economical means of modern day distribution. Serving the industry with Super de Lavaud cast iron pipe centrifugally cast in modern long lengths with standardized Mechanical Joints, Bell and Spigot or Flanged, with or without centrifugally applied cement lining. Rugged, dependable and economical.

General Sales Offices
ANNISTON, ALABAMA

We invite inquiries to our nearest sales office

122 So. Michigan Avenue, Chicago 3, Ill. — 350 Fifth Avenue, New York 1, New York

ALABAMA PIPE COMPANY
ANNISTON ALABAMA



In the HEART of
DETROIT
Facing Grand Circus Park

First thing to do in Detroit is check in at Hotel Tuller! You'll enjoy every minute. Newly modernized. Beautifully decorated. Within walking distance of all downtown stores, theatres and business activities . . . yet, you enjoy the evergreen atmosphere of Grand Circus Park . . . The Tuller Coffee Shop or Cafeteria for excellent food modestly priced.

VISIT OUR
COCKTAIL LOUNGE
ONE OF DETROIT'S FINEST

800 ROOMS from $3

Harry E. Paulsen, *Gen. Mgr.*

HOTEL TULLER

The Reds Broke Through

Marine S/Sgt.
Archie Van Winkle
Medal of Honor

ATTACKING IN DARKNESS, a superior Red force had smashed through B Company's defense line, near Sudong. Staff Sergeant (now Second Lieutenant) Van Winkle's platoon lay pinned under murderous fire. The entire Company faced destruction.

Passing a command through his platoon, the sergeant leaped from cover, led a desperate rush against the enemy. A bullet shattered his left elbow, but he kept going. The left-flank squad got separated. Sergeant Van Winkle dashed 40 yards through heavy fire to bring it in. An exploding grenade seriously wounded his chest. Still, lying on the ground, he continued to direct the fighting.

Finally he was evacuated, unconscious from loss of blood; but the breakthrough had been plugged, the Company saved.

"I found out firsthand," says Sergeant Van Winkle, "that the Reds respect only one thing—strength. But America has plenty, thanks to our armed forces who serve in the field—and good citizens at home who invest in our country's Defense Bonds! I believe in Bonds—as savings to protect my family and as strength to protect my country. I own them—and I hope you do, too!"

★ ★ ★

Now E Bonds pay 3%! Now, improved Series E Bonds start paying interest after 6 months. And average 3% interest, compounded semiannually when held to maturity. Also, all *maturing* E Bonds automatically *go on* earning—at the new rate—for 10 *more* years. Start investing in Series E Bonds through the Payroll Savings Plan; you can sign up to save as little as $2.00 a payday if you wish.

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cussed, and recommendations given for using it (1) as a preventive, (2) as a remedy for partial root stoppages, and (3) as an agent for clearing complete root stoppages. R-D can't harm the skin or clothing of the user and is safe to use in all types of sewer lines. According to the folder it is harmless to cesspools and septic tanks, and to trees and shrubs—although it kills roots, in sewers, which are not actually submerged in liquid.

Water, Sewage, Waste Treatment Equipment

723

Link-Belt Company, Chicago, Ill., has just published a 16-page book on **Water, Sewage, and Waste Treatment Equipment.**

Case histories of typical installations, large and small, with photographs and schematic drawings, are presented.

The booklet shows, for example, how a Virginia city treats sewage for ¼ cent per day per capita; how a railroad halted stream pollution through proper removal of oils and suspended solids; how a resort town provides for ten times greater sewage flow in summer than in winter.

Many types of Link-Belt Sanitary Engineering Equipment are pictured, including Straightline and Circuline collectors, Thru-Clean and Straightline bar screens, Tritor screens, Straightline and flash mixers, scum breakers, grit collectors and washers.

Condensation Control Charts

724

The Insul-Mastic Corporation of America, Pittsburgh, Pa., has produced a four-page folder containing charts which claim to show the exact degree of protection from condensation which is afforded by **Insul-Mastic Type "D".**

The company states that Type "D" is a heavy, spray applied coating which was produced to be used where a moderate amount of insulation is needed in conjunction with a corrosive preventive.

Through the use of the Insul-Mastic charts, it is said to be possible to tell to what degree the surface temperature will be raised after Type "D" insulation has been applied. To determine this the temperature of the equipment and that of the ambient air must be known.

Since relative humidity plays the important part in condensation, these charts also show the percent of relative humidity above which condensation will form on a bare surface at various surface and ambient temperatures. For comparison, the charts also show the increased percentage of relative humidity necessary before condensation will occur when the same surface is coated with ¼" or ⅜" of Insul-Mastic Type "D" . . . the surface and ambient temperatures being the same.

UV and Visible Spectrophotometers

725

Beckman Instruments, Inc., South Pasadena, California, has just released an inclusive 28-page catalog of **Beckman Ultraviolet and Visible Spectrophotometers** — picturing all sample cells and other accessories.

The two-color brochure contains detailed descriptions and illustrations of the Model B and DU Spectrophotometers—precision instruments which measure and identify substances by passing light through them.

Such well-known auxiliary units as the Flame, Reflectance and Fluorescence attachments also are described. These multiply the analytical uses of spectrophotometry without requiring a heavy outlay for new basic instruments.

The catalog features an extensive section treating the complete line of Beckman spectrophotometer cells, interchangeable sample compartments and cell adapters. A composite price list-index is also furnished.

Self-Molding Packing Compound

726

Surveys, Inc., Trenton, New Jersey has just published a bulletin on how oxygen corrosion in pipe lines can be arrested and prevented with **Molyseal.** According to the bulletin, Molyseal is a self-molding packing compound which carries Molybdenum Sulfide as a non-oxidizing dry lubricant in an exclusive formula.

This is the first time that this material has been used for this purpose. The bulletin describes how it is furnished, its use and what it will accomplish. It includes recommended operating ceiling loads, and shows loss due to leaks per month in pounds and dollars.

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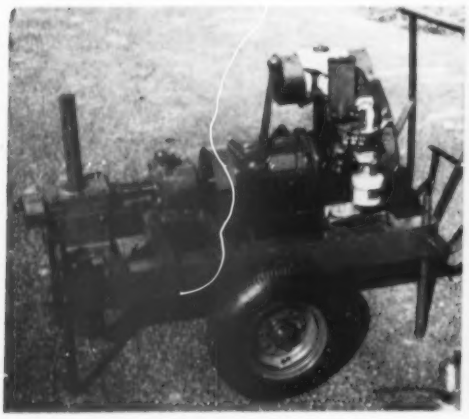

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Double-X Mechanical Joint Pipe

727

American Cast Iron Pipe Company, Birmingham, Ala., has just published a **Double-X Mechanical Joint Pipe catalog.**

This illustrated 44-page catalog discusses Mono-Cast centrifugal pipe in diameters 3 to 48 inches inclusive and the American Double-X mechanical joint. Complete standard specifications and other useful data are also included.

Automatic Mono-Column Demineralizer

728

Penfield Manufacturing Co., Inc., Meriden, Conn., has released a catalog data sheet on a **Fully Automatic Mono-Column Demineralizer.**

The front of the catalog sheet contains a photograph and schematic diagram of the demineralizer and the back contains a detailed description of parts, sample specifications and performance data.

Spiral-Glas and Plastic Pipe

729

Bettis Corporation, Houston, Texas, has released two fact sheets on the company's **Spiral-Glas** and **Clear-Vu pipe.**

According to the fact sheet, Spiral-Glas pipe is designed with a tensile strength of up to 600,000 lbs. p.s.i., and with a working pressure of 200 lbs. The pipe is said to be practically corrosion proof and has a glass smooth interior.

ClearVu pipe is made of virgin Butyrate and is provided in sizes of from ½ to 4 inches in standard graduations. Instructions for installing this pipe are included on the fact sheet.

Recording Potentiometers

730

Minneapolis-Honeywell Regulator Company, Brown Instruments Division, Philadelphia, Pa., has just published three new 4-page specification sheets that describe and illustrate **Brown ElectroniK Recording Potentiometers.**

Specification Sheet 160 covers circular chart recorders; Specification Sheets 164 and 165 cover single and multiple record strip chart recorders. Complete construction and engineering details are included.

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731

Multi-Metal Wire Cloth Co., Inc., New York, N.Y., has just published an 8-page, 2-color bulletin entitled **"You Dream It Up, Multi-Metal will build it."**

The bulletin in addition to discussing what the company does, gives case histories of actual problems in filtering, straining, washing and screening and how these were solved. Photographs illustrate each problem.

Simplified Flow Metering Calculations

732

The Foxboro Company, Foxboro, Mass., has released a new **Technical Information Sheet** for engineers and superintendents of water and sewage installations. The new publication, containing six pages of practical information on flow metering, is well illustrated with tables and curves, providing a simple method of calculating such factors as flow meter differential, orifice size, Venturi throat size, power consumption, capital investment and recovery period.

Two of the graphs are used in determining the relationship between rate-of-flow, flow meter differential and the ratio between orifice or throat size and the diameter of the pipe. Sample problems demonstrate how these graphs save time in calculating the unknown factors.

A third set of curves plots the pressure loss in % differential between the diameter of the primary device (orifice plate, Venturi tube, etc.) and the pipe size. Such graphs provide a valuable reference source in circumstances where allowable head loss across the primary device is limited or where power costs are likely to be excessive.

Still another nomograph permits quick estimates of relative power costs, useful in comparing a Venturi tube and an orifice plate from the standpoint of economy in a particular metering installation.

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INDEX TO ADVERTISERS

A

Alabama Pipe Co. 110A
*American Cast Iron Pipe Company 23A
*Anthracite Equipment Corp. 115A
Atlas Mineral Products 94A

B

Bethlehem Steel Company 25A
B-I-F Industries 4A-92A
Blackburn-Smith Mfg. Co. 103A
Buffalo Meter Co. 32A
Builders-Providence, Inc. 28A-92A
Byers Company, A. M. 10A

C

Carson Co., H. Y. 115A
Cast Iron Pipe Research Ass'n 26A-27A
Cement Gun Company 103A
Centriline Corp. 84A
Chain Belt Company 3rd Cover
Champion Corporation 80A
Chapman Valve Mfg. Co. 2nd Cover
*Chicago Bridge & Iron Co. 11A
*Chicago Pump Company 77A
Climax Engine & Pump Mfg. Co. 100A
Clow & Sons, James B. 33A
Continental Steel Corporation 113A

D

Darling Valve & Mfg. Co. 24A
DeLaval Steam Turbine Co. 22A
Dresser Manufacturing Division 20A

E

Electric Machinery Company 28A

F

Fairbanks-Morse & Co. 31A
Filtration Equipment Corp. 113A
Flexible Sewer-Rod Equipment Co. 108A
Ford Meter Box Co., Inc. 104A
Fowler Co., Inc., H. D. 106A

G

General Electric Co. 14A-15A
Greenlee Tool Co. 109A

H

Hagan Corporation 19A
Hamilton-Kent Manufacturing Co. 85A
Hardinge Company, Inc. 105A
Healy-Ruff Company 109A
Hersey Manufacturing Company 17A
Hills-McCanna Company 101A
Homelite Corp. 3A
Hydraulic Development Corp. 112A

I

*Industrial Chemical Sales 21A

J

*Johns-Manville 18A

K

Keasbey & Mattison Company 12A
Koppers Company, Inc. 16A

L

Lakeside Engineering Corp. 80A
Leadite Company 113A
Leopold & Co., F. B. 105A
Leupold & Stevens Instruments, Inc. 99A

M

McDonald Mfg. Co., A. Y. 9A
McWane Cast Iron Pipe Co. 86A
*M & H Valve and Fittings Company 90A
Minneapolis-Honeywell Reg. Co. 79A
Morris Machine Works 97A
Morse Bros. Machinery 96A
Mueller Company 30A

N

Neptune Meter Company 34A
Niagara Alkali Co. 29A
Northrop & Company 107A

O

Omega Machine Co. 4A-92A

P

Pacific Flush Tank Co. 8A
Pacific States Cast Iron Pipe Co. 86A
Payne Dean & Co. 112A
*Permutit Company 81A
Phipps & Bird, Inc. 109A
*Pittsburgh-Des Moines 13A
Pollard Co., Joseph G. 115A
Portland Cement Association 93A
Price Brothers Company 83A

R

Roberts Filter Mfg. Co. 113A
Rockwell Co., W. S. 107A
Rockwell Mfg. Co. 6A
Rodney Hunt Machine Co. 89A
Roots-Connersville Blower Division 95A
Ross Valve Mfg. Co., Inc. 102A

S

Smith Mfg. Co., A. P. 98A
Smith & Loveless, Inc. 82A
Speelman Elevated Tank Service 115A

U

*United States Pipe and Foundry Co. 7A

W

Walker Process Equipment Inc. 91A
*Wallace & Tiernan Co., Inc. Back Cover
*Welsbach Corporation, The 78A
Wood & Co., R. D. 88A
Worthington Corporation 87A

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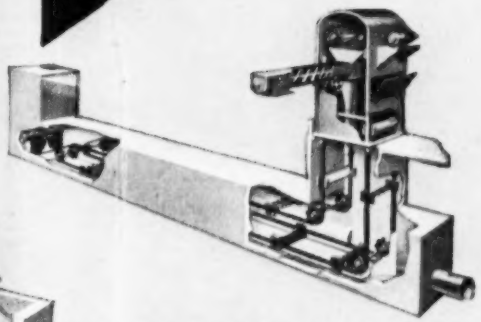

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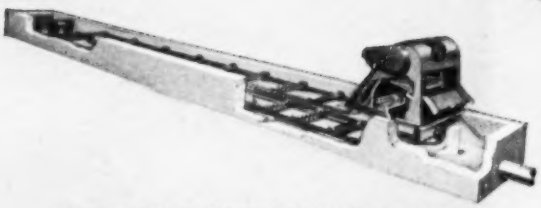

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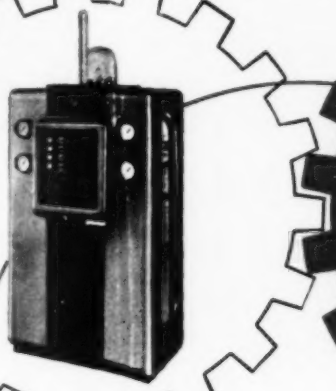

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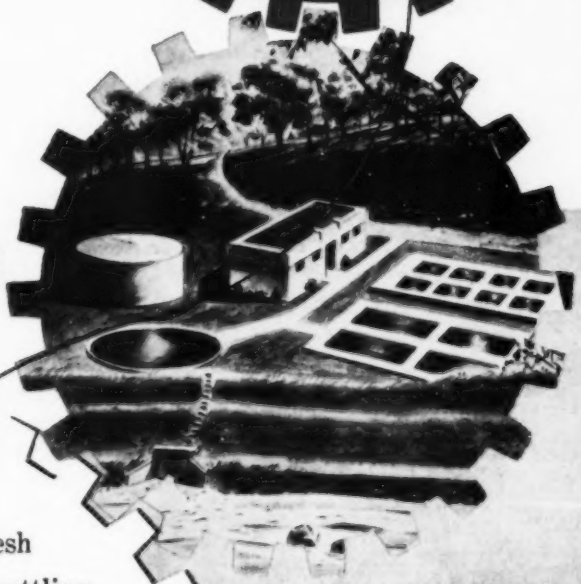

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